Smithsonian Institution 9-29-15

MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE. Assistant Editor: FRANK OWEN STETSON.

VOL. XXXIV. MAY, 1906. No. 5

The MONTHLY WEATHER REVIEW is based on data from about 3500 land stations and many ocean reports from vessels taking the international simultaneous observation at Greenwich noon.

Special acknowledgment is made of the data furnished by the kindness of cooperative observers, and by Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt I. S. Kimball, General Superintendent of the United States Life-Saving Service; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Secretary, Meteorological Office, London; H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; Señor Anastasio Alfaro, Director of the National Observatory, San José, Costa Rica; Rev. L. Gangoiti, Director of the Meteorological Observatory of Belen College, Havana, Cuba.

As far as practicable the time of the seventy-fifth meridian, which is exactly five hours behind Greenwich time, is used in the text of the MONTHLY WEATHER REVIEW.

Barometric pressures, both at land stations and on ocean vessels, whether station pressures or sea-level pressures, are reduced, or assumed to be reduced, to standard gravity, as well as corrected for all instrumental peculiarities, so that they express pressure in the standard international system of measures, namely, by the height of an equivalent column of mercury at 32° Fahrenheit, under the standard force, i. e., apparent gravity at sea level and latitude 45°.

SPECIAL ARTICLES, NOTES, AND EXTRACTS.

PRESENT DAY CLIMATES IN THEIR TIME RELATION.

By FRANK MORRIS BALL, Department of Geology, University of Minnesota. Dated Minneapolis, Minn., April 10, 1906.

It is often asserted by people who have lived in a locality for many years that the climate of their region has undergone marked changes during their residence, the most common statements being that cold weather came earlier in the fall, that greater snowfall was experienced, that the thermometer registered more continuously low temperatures in years past than at present, and that the rainfall is increasing or decreasing in amount. In the light of the modern science of statistics these statements are open to serious question. The human organism is at best an inaccurate register of temperature, and memory is more liable to be impressed with some single manifestation of weather than with the average of weather conditions which go to make up climate. A vivid impression of a day on which the thermometer registered 40° below zero is quite likely to remain in the mind for a long time, but the week of moderately cold weather which followed the cold snap and which, when averaged with the lowest temperature noted, made only average winter weather, is quite likely to be unnoticed, or, if noted at all, soon forgotten.

The introduction of instruments for the measurement of weather conditions, and the registration of all temperature changes according to an absolute instead of a relative standard show conclusively that when a long period of years is considered climatic averages are essentially stable.

The accompanying tables illustrate this stability of climate at places widely separated and subject to the control of different climatic factors.

Tables 1 and 2 show the annual temperatures and rainfall for neighboring localities in Minnesota.

Hann's Handbook of Climatology quotes the computations of Angot on the dates of vintage in France since the fourteenth century. Table 3 shows an oscillation but no permanent change in climatic conditions during this long period.

Tables 4 and 5, given by Russell in his book on meteorology, show temperature averages for St. Petersburg, Russia, and Philadelphia, Pa.

When long periods of years are considered, an oscillation of climate seems to be apparent. Thus for North America an 11-year oscillation has been computed, corresponding to the sun-spot cycle. This variation has not been shown to be persistent or general in occurrence. In Europe a 36-year period of oscillation of both rainfall and temperature is claimed by Brückner to occur. These variations are always slight, however, and do not as a rule exceed 0.5° to 1° on either side of the established mean.

TABLE 1.—*Average temperature compiled from records kept at Fort Snelling and St. Paul, Minn., since 1822.*

[From C. W. Hall's Geography of Minnesota.]

Years.	°F.
1822–1824	43.33
1825–1829	46.00
1830–1834	46.00
1835–1839	43.60
1840–1844	42.00
1845–1849	43.60
1850–1854	44.40
1855–1859	41.00
1860–1864	42.80
1865–1869	41.80
1870–1874	42.80
1875–1879	42.80
1880–1884	43.40
1885–1889	42.20
1890–1894	43.00
1895–1899	43 00
1900–1901	44.60
1822–1849	44.09
1850–1877	42.60
1878–1901	43.16

TABLE 2.—*Annual rainfall at Minneapolis, Minn., since 1866.*

[Compiled by C. W. Hall from the records of William Cheney.]

Years.	Inches.
1866–1871	32.29
1872–1881	27.83
1882–1891	27.09
1892–1901	29.55
Average, 1866–1901	28.85

The accompanying tables show that no permanent changes of temperature were experienced at the places quoted during the periods of time recorded. It would be beyond the power of actual demonstration to say that the figures prove an abso-

lutely stable climate, but on the other hand no figures exist which prove that climates have changed within the period covered by scientific investigation.

TABLE 3.—*Average of vintage dates at Dijon, France.*

[Compiled by Angot.]

Period.	Date.
14th century (13 years only)	October 25th.
15th century (60 years only)	October 25th.
16th century	October 28th.
17th century	October 24.5th.
18th century	October 28.8th.
19th century (80 years only)	October 30th.

TABLE 4.—*Temperature averages at St. Petersburg, Russia, 1743–1875.*

Years.	°F.
1743–1761	39.00
1762–1779	39.60
1780–1800	37.90
1801–1821	37.80
1822–1836	39.20
1836–1869	38.50
1869–1875	37.90
Mean	38.60

TABLE 5.—*Temperature averages at Philadelphia, Pa., 1758–1889.*

Years.	°F.
1758–1777	52.60
1798–1804	54.20
1829–1838	51.50
1825–1845	53.10
1846–1867	54.00
1871–1889	53.10

If we stop a moment to reflect that the factors of climate are under the direct control of natural laws, no surprise will be occasioned because of the permanency of climatic averages. That seemingly most wilful and lawless of all elements, the wind, is no less under the direct control of law and responds to it with no less unhesitating obedience than does the earth to the law of gravity in its yearly swing about the sun.

Speaking generally, we may say that any climate is determined by the following factors:

1. Distance from the equator. 2. Elevation above sea level. 3. Distance from large bodies of water. 4. The character and arrangement of surface features. 5. The direction of prevailing winds. 6. When long periods of time are concerned, the distance of the sun from the earth and the attitude of the hemispheres of the earth to the sun during aphelion and perihelion. 7. The relative amount of carbon dioxide present in the atmosphere. Of these elements controlling climates only the 5th is considered variable during periods measurable by man. However, if we classify wind systems and consider the two most important in relation to weather changes, namely, the permanent and cyclonic circulations, we shall see that the permanent winds can not be thought of as variable; a study of cyclonic circulations will bring conviction that these, too, are subject to laws as rigid as the permanent trades and westerlies. The conviction of orderliness of cyclonic movement and the regularity of cyclonic occurrence must stand in place of a demonstration, because of the lack of a clearly stated law of progression of the important wind systems. That they are capable of reduction to formulæ no one doubts, but the efforts of meteorologists in this direction have proved unavailing. As far then as shown by facts which are at hand we must conclude that all climates that have been scientifically observed remain invariable.

No better proof of the relative nature of all human knowledge and the temporary character of all human conclusions can be found than in the above paragraph. The most elementary knowledge of geology and related earth sciences is sufficient to prove that climates have changed many times in the geologic ages through which the earth has passed. All theories accounting for such changes lead irresistibly to the conclusion that climates to-day must be changing, although not in any measurable amount. Within the last three years fresh evidence of undoubted glaciation has been found at the base of rocks of Cambrian age. In Carboniferous time plants requiring an even and uniform climate the year round flourished over most of eastern North America. One of the most remarkable of recent discoveries is the finding of Miocene plant beds in northern Greenland and Spitzbergen. From these places more than 137 species of plants have been described. Oaks, maples, beeches, plane trees, poplars, limes, sequoias, magnolias, pines, firs, spruces, and cypresses, all reaching large tree dimensions, are found in fossil beds within 8° 15′ of the north pole. Of more than twenty species of sequoias which were once scattered over North America from the Pacific to the Atlantic Ocean, only two species are found to-day and they are confined to the Pacific slope. In the stagnant waters of what is now an uninhabitable land waterlilies bloomed and the margins of lakes were thickly clothed with a green mat of sedges and rushes. During the same geologic epoch crocodiles basked in the warm waters of the great interior lakes of France, the hippopotamus wallowed in the mud of the London basin, and lions, tigers, giraffes, tapirs, elephants, and rhinoceroses ranged over the whole of Europe. Instances might be multiplied to prove the existence of a propitious climate over most of the Northern Hemisphere during this same epoch. Reading the record onward through Pliocene or Pleistocene epochs it is noted that the equable climate of the Northern Hemisphere gradually gives way under gradual refrigeration to the climatic conditions of Glacial time. Ages passed and the climate again changed, giving us the present climate, which has been such a spur to the ambition and activity of the northern races. When, therefore, we made the implied statement that climates do not change, we took the little period of recorded history as the measuring stick of an eternity. The fact is that climates do change from age to age, but the rate of change is so slow that the duration of time covered by human occupation has been too short to measure a transition from colder to warmer climatic conditions or vice versa.

Of these past climatic changes, two types may be distinguished—changes that are somewhat local in character, and changes that are more universal and affect the greater part of a hemisphere. It is known that during comparatively late geological time the Gulf of Mexico extended northward as far as Cairo, Ill.; that a vast mediterranean sea covered all the southern part of Russia and extended over western Siberia to the Arctic Ocean; that all the northern portion of the African Sahara Desert was covered with a shallow sea, and that central Asia was sea instead of land. During the progress of time since those conditions obtained, seas then existing were filled and lifted above sea level. There can be no question but that an extension of the Gulf of Mexico northward would affect the climate of all middle North America, or that the great Russian sea would equalize and make humid the regions that are now waste deserts. The land east of the Sahara Desert must have been influenced by a climate entirely different from that of the present, and the lands lying north and south of central Asia must have passed through wonderful climatic changes to reach their present temperatures. These local changes of land and sea areas must have affected the climates of all surrounding lands enormously, and every minor change in coast lines has had its effect on the climate of more restricted areas. Besides these changes of climate, there have occurred those greater variations of temperature and moisture relations noted in the Cretaceous-Miocene and the Miocene-Recent intervals. The character of the Miocene-Recent climatic changes will be brought out later in this paper.

All geologists agree that the climate of the Northern Hemisphere changed from colder to warmer during the Cretaceous-Miocene interval, and that a gradual refrigeration of climate

was experienced in passing from the Miocene to the Glacial, and it is just as evident that the glacial cold gave way to the temperate atmospheric conditions of recent time. The fact of the change is evident, but the cause of the change is obscure. In accounting for the thorough glaciation of northern North America and Europe many theories have been advanced.

One of the best known theories is that of Doctor Croll, put forth in his work, "Climate and Time," in 1875. Croll built upon the hypothesis that a Glacial age could be brought about by astronomical causes which would furnish the basis for a series of changes in the influence of climatic factors upon the temperature of the earth's atmosphere. It is very well known that the sun does not stand at the center of the earth's orbit, but at one time of year the earth is some millions of miles nearer the sun than at the opposite period of the annual revolution. Working in conjunction with this change in distance from the sun is what is known as the precession of the equinoxes; that is, the poles of the earth do not point at all times at the same spot in the heavens, but on the contrary each describes a circle which may be likened to that described by the axis of a top when its speed is much reduced. This precessional movement is extremely slow, one revolution, relative to the apsides, being completed in every 21,000 years.

The inclination of the earth's axis is approximately 23.5°. It is due to this inclination that within each annual cycle the Northern and Southern hemispheres are alternately presented to the sun and thus experience their seasonal changes of temperature. If the North Pole points away from the sun at the time that the earth is at the greatest distance from that luminary, the temperature of the Northern Hemisphere will be greatly reduced. At the present time in the Temperate Zone the greater part of the moisture precipitated is rain, even during the winter; the small portion of moisture which falls as snow disappears within a few weeks at most. But the increased cold which would exist if the North Pole pointed away from the sun at the time of aphelion would result in the precipitation of all the moisture as snow. Not only would the winters be longer, but they would be colder as well. Croll figures that "at present the winters are eight days shorter than the summers, but with the eccentricity at its superior limit and the winter solstice in aphelion the length of the winters would exceed that of the summers by no fewer than 36 days". Lowering the temperature and increasing the number of cold days would tend to increase the amount of snow accumulation during the winter. The result would be that after a period of years with increasing cold the accumulation of snow would be greater than the heat of the short summer could melt. When this condition had been reached, the accumulation of snow would so decrease the summer temperature by radiation and reflection of heat that the air would be cold the year around. The cooling of the atmosphere would result also in the formation of thick banks of fog and clouds, which would shield the earth from the sun's rays and so prevent melting.

The conditions outlined above are insufficient of themselves to bring on a Glacial epoch, but they form the basis of changes upon the earth that appear of sufficient magnitude to cause refrigeration. The chief of these causes is the deflection of ocean currents. It is generally admitted to-day that the chief cause of ocean current movement is the action of the permanent winds on the water surface,[1] and it is evident that any disarrangement of the trades or westerlies would seriously affect the direction and extent of these temperature equalizers, the ocean currents. Croll argues that the reduced temperature of the Northern Hemisphere, occasioned by astronomical causes, would be accompanied by exactly opposite effects in the Southern Hemisphere, where the shortness of the winter and the nearness of the sun in winter would prevent snow accumulation. There would, therefore, be a great difference in temperature between the Northern and Southern hemispheres. This accentuated temperature difference would result in an unusually strong movement of air southward toward the warmer belts, and as a consequence the northern trades would be much stronger than the southern trades, the result being that the belt of equatorial calms would be located at some distance south of the geographical equator. The peculiar wedge-like character of the eastern South American coast would split a surface current impinging upon its angle, or it would deflect southward a current striking south of the angle. It is plain that if the northern were much stronger than the southern trades, the drift of water from the African shore would strike below the point of the wedge and thus flow southward along the Brazilian coast. If none of the waters of the Gulf Stream found their way northward, the amount of heat denied the north Atlantic would be equal to one-fourth the entire amount received upon that area from the sun.[2] "The stoppage of the Gulf Stream," says Croll, "combined with all those causes which we have just been considering, would place Europe under a glacial condition."

A later glacial theory than that advanced by Croll is supported by perhaps the greater number of geologists in the United States to-day. The central idea of this hypothesis is that the chief cause of the refrigeration of climate is to be found in the elevation of large land areas in the high latitudes. The period of geological history just preceding the Glacial epoch is known to have been a time that witnessed the emergence of large land areas over the Northern Hemisphere. It is claimed by the supporters of the elevation hypothesis that the elevation was sufficient to cause the moisture of the air to be precipitated in the form of snow instead of rain. This precipitation was sufficient in amount to prevent its complete melting away during the summer. Glacial conditions once established would be perpetuated through the radiating and reflecting powers of snow and ice acting together with the original cause producing glaciation.

The latest glacial hypothesis is announced by Prof. T. C. Chamberlin, of Chicago, who finds the cause of refrigeration in the depletion of the air of its carbon dioxide. It is well known that the atmosphere would be incapable of holding sufficient heat to support life if it were depleted of its carbon dioxide, its water vapor, and its dust particles. These three components of the air act as conservers of the radiant energy received from the sun by the earth. The slow giving up of the heat derived by the earth from the sun keeps the surface air at a medium temperature. If, however, the above-named three elements were removed from the air,[3] and especially the carbon dioxide, then radiation would keep pace with absorption, thus producing permanent glacial conditions. Doctor Arrhenius, as quoted by Chamberlin, is authority for the statement that a reduction of 45 to 48 per cent of the present amount of carbon dioxide in the air would bring on glacial conditions, and that an increase of 2.5 to 3 times its value would restore the mild temperatures of Tertiary time over the Northern Hemisphere. (Journal of Geology, vol. 5.) The cause of the depletion is ascribed to the enormous degradation of granitic rocks which would occur during the exposure of great land surfaces. The depletion would be furthered by the storing up of carbon dioxide through the agency of plant and animal life. The gradual exhaustion of the carbon dioxide from the air would bring on a period of cold, which would last until the carbon dioxide balance had been restored

[1] We understand this to refer to surface currents, whereas differences of temperature and saltness as affecting density are important in the general conditions.—EDITOR.

[2] Croll, Climate and Time, Chapter 2.

[3] Of course this implies that vapor and water, lakes and oceans, flora and fauna are removed, but the argument of the rest of this paragraph implies that water and vapor still remain.—EDITOR.

through the reduced rate of denudation of granitic rocks brought about by restricted land areas, and the feeding back into the atmosphere of enough carbon dioxide to stop the rapid radiation of heat from the surface.

Whatever the cause of glaciation, be it cosmical or terrestrial, or any combination of the two, it is almost certain that the cold came on slowly, and, after the several Glacial and inter-Glacial advances and retreats had succeeded one another, it passed slowly away. The coming of the cold was deliberate enough to allow of changes in animal structure, as evidenced by the woolly rhinoceros and the mammoth. These animals, up to this time devoid of hair, took on a fine woolly coat as a protection against the cold. Plants migrated southward as the cold increased from year to year, and a great many species placed themselves beyond the reach of the ice. The last retreat of the ice front and the coming of warmer weather allowed these species to gradually take possession of the ground from which they were driven, until at present plants bloom in the most northern regions uncovered by the ice in summer.

Most explanations of the cause of glaciation agree that during the period of northern cold the southern lands experienced a mild and even tropical temperature. The wind systems, under this arrangement, would necessarily be different from the wind systems of to-day. First, the exchange of air between the Arctic and Torrid zones would be accomplished by stronger currents than at present, because of the then greater differences in temperature between Arctic and Tropical regions. Second, the exchange of air between the relatively warmer sea and the great ice fields would be continuous throughout the whole period of cold. At present the temperate land areas are relatively warmer than the ocean only in the summer season, and air currents at this time flow from the sea toward the land. In the Glacial age this tendency would be reversed, and the air would flow from land to sea through the whole period of cold. The direction of winds would be subject to the same laws as at present. In Glacial time there was then the same system of trade and antitrade winds as at present, except that these winds were in all probability stronger and extended much farther beyond the geographical equator than they do to-day. There was no doubt a permanent system of westerly winds, but it must have extended over a zone of land and water much nearer the equator than the westerlies of to-day. If our present cyclonic systems existed, and there seems to be no reason why they should not have existed, they too must have formed and traveled eastward in a belt below the Ohio River. The chief wind systems of the glaciated area would be the transfer of air from Tropic to Arctic regions and from ice field to sea. The low temperature necessary for refrigeration would condense to snow all moisture brought from the moist warm regions by the return air currents, so that, whereas most of our moisture is now received in the form of rain, the moisture of Glacial time would be precipitated entirely as snow within the area of glaciation.

If we would grasp the relation of our own climates and see where they stand in the grand oscillations of temperatures in the past, we must picture the slow passing away of glacial conditions, which is not completed even to-day. We are now experiencing a phase of climatic oscillation which had its beginning thousands of years ago. The different published opinions as to the length of time since the retreat of the last ice sheet from our continent would justify an approximate estimate of 10,000 years. Whatever the causes producing glacial conditions may be, these are evidently brought about by the operation of forces acting through immense stretches of time, and the effects of such glaciation pass away as slowly. The conditions of the past 10,000 years, or more, during which the ice has melted away from the land between the Ohio River and the Arctic Circle, have not yet carried the Northern Hemisphere beyond glacial conditions. We are still living in the Glacial epoch. Greenland, a country of approximately 512,000 square miles, has an ice cap of 320,000 square miles area and a thickness of not less than 2000 feet. From the high mountains of Europe and Asia and from the middle and northern Rockies of North America long tongues of ice still force their way down through the valleys, and throughout the whole North Temperate Zone snow lies upon the ground for several months each year. The larger part of the great plains of Canada and Siberia, similar to the Mississippi Valley and the fertile stretches of northern Europe in all other respects except those depending directly upon climate, still lie barren and all but useless because of the forbidding cold. Should Miocene climate return to the earth these magnificent reaches of land would be capable of supporting more population than the earth now possesses. We are moving away from extreme glacial conditions at the present time, but we have not yet passed beyond the general conditions of that period of cold. Whether we are approaching conditions when Greenland will again be the home of palms and corals no man can say.

Viewed in their broader connections our present climates, at least of the Northern Hemisphere, are but stages in the grand oscillation of temperature between the tropical heat of a Miocene epoch and the arctic cold of a Glacial, on the one hand, and the temperate heat of a recent and possibly the tropical heat of some future epoch yet unnamed, on the other.

The winds, which are warmed by the mild Pacific Ocean and sweep across the western slopes of California and Oregon, owe their existence to the fact that the axis of the earth is inclined a few degrees to the plane of revolution; that the earth is a spinning ball, and that land and water areas under the sun's rays are unequally heated in like periods of time. The high plains of America and Asia, as well as those of Africa, owe their aridity to their position in latitude and to the protecting mountain walls thrown around them. Lower the American cordilleras 3000 feet and the arid regions west of the Mississippi River will cover themselves with forests of magnificent extent, the angular Bad Lands will take on the rounded forms of an Appalachia, and the sand-choked rivers of the West will be lined with happy, industrious cities from the one hundredth meridian to the Pacific Ocean.

Speaking broadly, we may look upon the present climates of the globe as depending upon certain arrangements of climatic units. If any one of these units should change, the whole climatic scheme of our present epoch would be disarranged. If, for example, the inclination of the earth's axis were to change so much that it became perpendicular to the plane of the orbit of the earth, the seasons would cease to change and the most delightful and helpful of our temperature variations would not exist. There would then be but one season, and that would last always. Each parallel of latitude would have its own peculiar temperature and moisture conditions, which would remain invariable from year to year. The nights and days would not vary their length a second from century to century. If the general temperature average of the earth were to decrease, the temperate regions could become almost arctic. In fact any change in the surface of a land area, or in the position and movement of the earth in space, or in the composition of the atmosphere, would destroy the delicate balance of the agents of climatic control now existing, and the result would be a revolution in the affairs of men, whose civilization has been built up in accordance with the present arrangement of winds and rainfall. Civilization has grown up in certain parts of the earth, and not in other parts, because of certain advantages that these more favored spots possessed over their less fortunate neighbors. No large cities exist upon Hudson Bay, and none can ever exist there under present climatic conditions. The heavy rainfall of the Amazon basin and the consequent swollen character of the rivers pre-

vents the extension of transportation lines in that region; the dryness of the Gobi Plateau has prevented China from expanding westward. What a nation shall raise depends upon the climate of the region in which that nation happens to be situated, and what is produced influences the laws, habits, and customs of the whole people. North America owes more to its variety of climate than to its variety of soil. A temperate climate, with its recurring periods of heat and cold, is responsible for our being the busy, bustling nation that we are.

RELATIONS BETWEEN VELOCITIES OF PROGRESSION OF LOWS AND THE AREAS OF RISING AND FALLING PRESSURE ACCOMPANYING THEM.

By STANISLAV HANZLIK, Ph. D. (Prague). Dated Washington, D. C., February 24, 1906.

Before entering on this subject, which is a further contribution to the answer of question No. 2, as stated in the introduction to my paper in the MONTHLY WEATHER REVIEW, August, 1904, Vol. XXXII, pp. 358–363, I wish to quote some lines from Professor Ekholm's paper in the Meteorologische Zeitschrift for August, 1904, to which I partially owe the impulse that started this study. Ekholm in his paper entitled "Weather Charts of Pressure Oscillations (Wetterkarten der Luftdruckschwankungen)" presents a suggestion how to better the present status of weather forecasting in Europe. In his introduction he quotes a proposition once made by the English meteorologist, Clement Ley, that thousands of weather charts should be systematically arranged in the form of a weather dictionary and made accessible to the public by publication. The forecast would then be given by predicting the appearance of a chart having a specific number in this dictionary. Ekholm says, "I do not know at present any better method than this one, and have for more than ten years been occupied with the construction of a weather dictionary".

In the next paragraph Ekholm turns to weather forecasting, to the methods of to-day and to the faults of the methods. After that he takes up the main subject of his paper, namely, the charts of pressure changes, and tries to show from a mathematical point of view the importance of such charts for a deeper understanding of the weather and improvement in weather forecasting. The interval between two successive charts should be so short that we may clearly see how the conditions shown by one chart developed from those of the preceding. In this way we learn the nature of the interpolation of the weather function and a proper understanding of this allows us to take the next step, i. e., the extrapolation from the last chart, or in other words the forecasting of the weather. This latter can be done only by means of empirical methods, on account of the incompleteness of our observations and the imperfections of theoretical hydrodynamics.

Ekholm explains the construction of pressure change charts as follows: Let us enter on our synoptic charts, for each station, the change of pressure from one reading to the next, and draw the lines of equal change; then we find, in general, closed curves of the same form as the cyclones and anticyclones. In one area the pressure has risen; he calls this the area of rise (Steigungsgebiet), with a place of greatest rise (Steigungscentrum), and similarly elsewhere an area of fall with a center of greatest fall.

According to Ekholm probably the first[1] who made use of these pressure change charts for weather forecasting in Europe was Brounow, who in 1878 published a paper entitled: *The pressure change charts and the method of determining the direction of motion of a barometric minimum in the immediate future*[2], wherein he shows that in certain cases the track of the low for the next day can be determined by means of the areas of fall and rise, but though he excludes all complicated cases the accordance with observations is not quite satisfactory. This subject was later investigated by Sresnewsky in his paper: *Large oscillations of the air pressure in the year 1887.*[3]

The results of the investigation on the relation of areas of falling and rising pressure to the lows are given by Sresnewsky in the following sentences:

(1) The center of the cyclone is always to the left of the point of most rapid fall of pressure. (2) This is explained as due to the great eccentricity of the outer isobars of the cyclone and also due to the difference of barometric gradients on both sides of cyclones. (3) The area of most rapid decrease in the southeast quadrant of the cyclone coincides with the area of strongest storms, and moves nearly parallel to the center of the cyclone. (4) There are cases when the area of fall moves apparently independently of the cyclone while the latter remains nearly stationary in the extreme north of Europe.

These are the most important points in Sresnewsky's investigation that concern the relations of cyclones to the areas of fall and rise. These atmospheric waves are, in Ekholm's opinion, very important phenomena. When there are strong storms in Swedish waters the areas of fall and rise follow similar tracks parallel to each other, while the cyclone keeps somewhat to the left of the track of the area of fall. When the cyclone reaches the land the intensity of the storm diminishes, the velocity of motion of the storm decreases, and the areas of fall and rise, with some delay, move in a southern or southwestern direction as if there were no apparent connection between them and the cyclonic area. The continued study of these areas of change in their relation to the cyclones led Ekholm to believe that for the weather and wind these are of greater importance than the cyclones themselves. "It seems to me highly probable", says Ekholm, "that these oscillations are caused by the cyclones and anticyclones of higher levels, which sometimes, but not always, cause a corresponding cyclone or anticyclone on the surface of the earth". Worthy of mention is the cyclonic character of the area of fall, namely the overcast sky and the occurrence of rain. Ekholm closes his paper with some remarks on the charts of change for other meteorological elements.

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While in Harvard University preparing my paper published in the MONTHLY WEATHER REVIEW (August 1904, page 358,) I tried to draw the pressure change charts for the study of different velocities of lows. I temporarily abandoned this work on account of the great labor, but when I obtained access to the pressure change charts in the central office in Washington I took the study up again with much greater interest, after I had read and thoroughly studied the above-mentioned papers of Ekholm and Sresnewsky.

For the investigation of the relations between the lows and the areas of rise and fall, I used a scheme which may be explained as follows:

I considered lows for three successive weather maps at intervals of twelve hours, for instance, 8 a. m., 8 p. m., and the next following 8 a. m.; or 8 p. m. and the next following 8 a. m. and 8 p. m. The length of the track between the three readings was measured and the lows were grouped in two classes: those with "increasing" and those with "decreasing" velocity—according to whether the length of the track in the second half, between the second and third observation,

[1] The charts of changes of temperature and pressure for each eight hours and twenty-four hours began to be constructed and used by the Weather Bureau (Signal Service) in 1872; the corresponding charts for twelve and twenty-four hours still continue. Many studies of these charts were made in the United States before or Brounow's paper of 1878.—EDITOR.

[2] P. Brounow. "Von den Aenderungskarten und die Methode, etc." Anhang zu dem Bulletin für das Jahr 1879. Central Physical Observatory, St. Petersburg, Dec. 18, 1878. (Lithograph, with 5 charts.)

[3] Ueber starke Schwankungen des Luftdruckes im Jahre 1887. Bull. Soc. Imp. Nat. Moscou, 1895, No. 3.

was longer or shorter by at least 200 miles than in the first half. For the determination of distances between the lows and the accompanying areas of falling and rising pressure a system of rectangular coordinates was used, but somewhat differently from the manner in which it was used by Sresnewsky.

A rigid rectangular system was so applied to a weather map that the coordinates of the center of the low for the second reading were $X_2=0$, $Y_2=0$; the track between the second and the third reading was made coincident with the positive axis of X, so that the coordinates of the low at the third reading were $X_3>0$, $Y_3=0$. The coordinates of the low at the first reading were $-X$, $+Y$, or $-X$, $-Y$ according to whether the track of the low was concave or convex toward the positive axis of Y. This may be understood from fig. 1. The positions of the areas of rise and fall[4] were expressed in the same system of coordinates. So for three readings of the low I had six additional readings of the areas of rise and fall. In order to express myself more briefly, I will use the following abbreviations: L_1 denotes the position of the *low* at the first reading, similarly L_2 and L_3; F_1 is the position of the area of *fall* which is associated with L_1, and similarly F_2 and F_3. A similar meaning attaches to R_1, R_2, and R_3 as denoting the positions of the areas of *rise* for three successive readings. Having thus taken from the manuscript pressure charts the coordinates of L_1, L_2, L_3; F_1, F_2, F_3; R_1, R_2, R_3; I could by means of these coordinates determine the following distances:

(1) F_1–F_2, F_2–F_3, and R_1–R_2, R_2–R_3; that is, the lengths of the tracks of the areas of fall and rise, respectively.

(2) R_1–F_1, R_2–F_2, R_3–F_3; that is, the respective distances of the areas of fall and rise as both advance with the low.

(3) R_1–L_1, R_2–L_2, R_3–L_3; that is, the distance of the area of rise from the low and also the change of this distance as the velocity of the low increases or decreases.

(4) F_1–L_1, F_2–L_2, and F_3–L_3; that is, the distance between the low and its accompanying area of fall and the changes of this distance.

For instance let us take one concrete case of a low with decreasing velocity.

Area of low pressure.						Area of falling pressure.						Area of rising pressure.					
Location.						Location.						Location.					
L_1		L_2		L_3		F_1		F_2		F_3		R_1		R_2		R_3	
X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
−140	+380	0	0	+220	0	−270	+320	−60	−40	+310	−80	−410	+860	−330	+630	−210	+380

From these the following values can becomputed:[5]

(1) F_1–F_2=416, F_2–F_3=372; the difference between these two is negative (i. e. the second minus the first) which means that the velocity of the area of fall has decreased. R_1–R_2 = 242, R_2–R_3 = 277; the difference between these is positive; hence, the velocity of the area of rise has increased.

(2) The distances R_1–F_1, R_2–F_2, R_3–F_3, are 559, 722, and 696, respectively. If we take into consideration only the last two numerical values, we see that the distance between the centers of rise and fall has shortened, namely, from 722 to 696.

(3) The distances F_1–L_1, F_2–L_2, F_3–L_3, are 144, 72, and 121, respectively. If, again, we consider the last two values, we see that the distance between the centers of the low and the falling area has lengthened, namely, from 72 to 121.

(4) Corresponding values for R_1–L_1, etc., or the successive distances of the centers of the area of rise and the low are 552, 713, 575. The last two values show that the distance between low and area of rise has decreased.

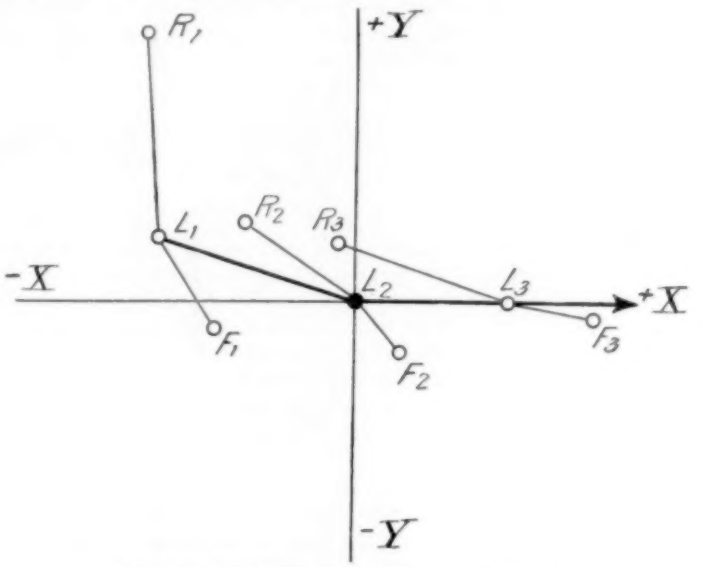

FIG. 1.—Coordinates of the centers of areas.

If we briefly summarize the results for the low in question, we have the following statements: First, the movement of the low decreased from 405 miles in the first twelve hours to 220 miles in the next twelve hours; second, the velocity of the area of fall preceding it decreased; third, that of area of rise increased; fourth, the distance between the areas of fall and rise decreased; fifth, the distance between the low and its forerunning area of fall increased; sixth, the distance between the low and its following area of rise decreased. If we denote the increase simply as (+) and the decrease as (−), we can briefly express the above by signs as follows:

1 Low (−)	2 F (−)	3 R (+)	4 RF (−)	5 FL (+)	6 RL (−)

TABLE 1.—*Lows moving with decreasing velocity.*

(N., NNE., NE., ENE., E., ESE., denotes the azimuth of the track of the cyclone between the second and third readings.)

Trend and length of track.	F.	R.	RF.	FL.	RL.	Trend and length of track.	F.	R.	RF.	FL.	RL.
N., NNE.						NE., ENE.					
51	+	−	+	+	+	83	+	−	−	+	−
51	+	+	−	+	−	64	+	−	+	+	+
42	−	+	−	+	−	64	−	+	+	+	−
42	+	−	−	+	−	64	+	−	−	+	−
82	+	?	−	+	−	64	−	?	+	−	−
53	−	−	−	+	−	74	−	+	−	−	−
53	−	+	−	+	−	75	−	+	−	+	−
73	+	+	−	+	−	75	+	−	+	+	+
64	+	+	−	+	−	85	−	?	+	−	+
64	+	+	−	−	+	95	−	−	+	−	+
86	−	?	−	−	−	97	+	−	+	+	+
75	+	?	+	−	+	E.					
NE., ENE.						41	−	?	?	+	?
31	+	−	−	+	−	51	{+ +}	+	{− −}	+ {	−
31	{+ +}	−	+	+ {	−		{+ +}		{− −}	+ {	
31	{+ +}	+	+	+ {		42	−	+	−	+	−
31	+	−	+	−	−	42	+	−	−	+	−
41	−	+	−	+	−	53	+	+	−	+	−
42	−	{+ +}	−	+	{− −}	63	−	+	−	+	−
		{+ +}			{− −}	73	+	−	+	+	−
42	−	−	−	−	−	84	+	+	−	−	−
42	−	−	+	+	+	75	+	+	−	+	−
52	+	−	−	+	−	ESE.					
62	{− −}	−	{+ +}	− {	−	52	−	−	−	−	−
	{+ +}		{+ +}	+ {		53	+	+	−	+	−
53	−	−	+	+	−	64	−	−	+	+	+
53	{− −}	−	−	+	−	64	−	−	−	−	−
	{+ +}					64	−	+	−	−	−
63	−	−	−	−	−	74	+	+	−	−	−

[4] In case of the coordinates of the areas of falling or rising pressure I mean the coordinates of the places of greatest change of pressure within the last twelve hours.

[5] We subtract the second values of X and Y from the first values, respectively, and compute the square root of the sum of the squares of their differences. To find F_1–F_2: $X_1-X_2=-210$; $Y_1-Y_2=360$; then

$$F_1\text{-}F_2=\sqrt{(X_1-X_2)^2+(Y_1-Y_2)^2}=\sqrt{(-210)^2+(+360)^2}=416.$$

TABLE 2.—*Lows moving with increasing velocity.*

(N., NNE., NE., ENE., E., ESE., denotes the azimuth of the track of the cyclone between the second and third readings.)

Trend and length of track.	F.	R.	RF.	FL.	RL.
N., NNE.					
13	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	+	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	−
13	−	−	−	−	−
13	+	+	−	−	−
18	−	?	−	−	+
24	+	?	−	−	−
25	+	−	+	0	+
25	?	−	+	−	+
35	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	+	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	$\left\{\begin{matrix}-\\+\end{matrix}\right\}$	+
36	+	−	+	−	+
46	+	−	+	+	+
48	−	+	−	−	+
NE., ENE.					
13	+	+	−	+	−
13	+	?	?	0	?
15	−	$\left\{\begin{matrix}+\\-\end{matrix}\right\}$	$\left\{\begin{matrix}-\\+\end{matrix}\right\}$	−	+
15	$\left\{\begin{matrix}+\\-\end{matrix}\right\}$	−	−	$\left\{\begin{matrix}-\\+\end{matrix}\right\}$	−
14	?	−	?	+	+
15	−	+	−	+	−
15	+	$\left\{\begin{matrix}-\\-\end{matrix}\right\}$	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	−	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$
15	−	−	−	−	−
18	+	+	+	−	+
18	−	−	+	−	+
24	+	−	−	−	+
24	−	+	−	−	−
24	−	+	+	+	−
24	−	+	−	−	−
24	+	−	+	+	+
24	+	+	+	+	−
25	−	−	−	+	+
25	+	+	−	−	−
25	−	−	+	−	+
25	+	+	−	−	−
25	?	−	?	?	+
25	+	?	+	−	+
25	+	−	−	−	+
26	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	−	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	$\left\{\begin{matrix}-\\+\end{matrix}\right\}$	+
26	−	+	−	−	+
26	+	+	−	−	−
27	+	+	+	−	+
27	+	−	+	−	+
27	+	+	−	−	0
27	−	?	+	−	+
27	−	+	−	−	+
35	−	+	+	−	+
35	−	+	−	−	+
35	+	+	−	+	−
35	−	+	−	−	−
35	−	+	−	−	−
35	+	−	+	+	+
35	−	−	+	−	+
35	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	−	+	−	+
35	−	−	+	−	+
35	+	−	+	0	+
36	+	+	+	+	+
36	−	$\left\{\begin{matrix}-\\+\end{matrix}\right\}$	+	−	+
36	+	−	+	0	+
36	−	−	−	−	+
36	−	−	−	−	+
36	$\left\{\begin{matrix}+\\-\end{matrix}\right\}$	?	$\left\{\begin{matrix}-\\+\end{matrix}\right\}$	$\left\{\begin{matrix}-\\+\end{matrix}\right\}$	+
36	−	+	+	−	+

Trend and length of track.	F.	R.	RF.	FL.	RL.
NE., ENE.					
36	+	−	−	−	−
37	−	$\left\{\begin{matrix}-\\-\end{matrix}\right\}$	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	−	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$
37	$\left\{\begin{matrix}+\\-\end{matrix}\right\}$	?	+	+	+
37	−	?	+	−	+
38	?	?	?	−	?
46	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	−	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	+
46	+	−	+	0	+
46	+	−	+	+	+
46	−	−	−	−	−
46	+	+	−	+	−
46	+	+	−	+	−
46	+	−	+	0	+
46	−	+	−	−	+
47	−	+	+	−	−
47	−	$\left\{\begin{matrix}-\\-\end{matrix}\right\}$	+	−	+
47	+	−	+	−	+
49	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	+	0	−	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$
57	+	+	−	−	−
57	−	−	+	+	+
58	−	−	−	−	+
58	+	+	+	0	+
68	−	−	−	−	+
E.					
13	+	−	+	+	−
16	+	−	+	+	+
17	−	−	+	−	+
18	−	−	+	−	+
24	+	−	+	−	+
24	+	+	+	+	−
25	+	−	+	−	+
26	−	+	−	−	+
26	−	+	+	−	+
26	−	+	+	−	+
27	+	+	−	−	−
35	+	−	+	+	−
35	+	+	−	+	+
35	+	?	?	0	?
35	?	−	?	?	+
35	+	−	−	−	+
35	?	−	?	?	−
36	+	$\left\{\begin{matrix}-\\-\end{matrix}\right\}$	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$	−	$\left\{\begin{matrix}+\\+\end{matrix}\right\}$
36	−	+	+	−	+
37	+	−	+	−	+
46	+	+	+	−	+
48	+	−	+	−	+
48	+	+	+	+	+
57	−	+	−	−	+
57	+	+	−	−	−
69	−	−	−	−	+
ESE.					
15	−	−	−	−	+
24	−	−	+	−	+
24	+	−	−	−	+
25	−	−	+	−	+
35	+	−	+	−	+
35	−	−	+	−	+
36	$\left\{\begin{matrix}-\\+\end{matrix}\right\}$	+	+	+	+
46	−	+	−	−	+
57	+	+	−	+	+

This process, thus exemplified, of computing the numerical values of the coordinates and distances was carried out for about 170 cyclones, which as above mentioned, were classified as lows with increasing and decreasing velocities, respectively. There were about 120 lows with increasing velocities and 50 with decreasing for the period 1893–1902.

I do not give here, *in extenso*, the tables for these 170 cyclones, with the distances enumerated under (1), (2), (3), and (4), as it would take too much space, but in Tables 1 and 2 give briefly the resulting (+) and (−) signs as just illustrated for the two groups of increasing and decreasing lows.

The first column gives the length of the track in the first and second twelve hours in brief form; for instance, (51) means that the center of the low moved with a velocity of between 500 and 600 miles in the first twelve hours, but decreased to a velocity of from 100 to 200 miles in the second twelve hours. It is plain that besides the signs (+) and (−) we may get results represented by the signs (?) and (0), the first case meaning that the distance could not be measured, the second, that there was no change. There are cases where the areas of fall and rise split, or another area is formed, so that two distances come under consideration, and therefore we have double signs of $\binom{+}{+}$, $\binom{-}{-}$, $\binom{+}{-}$, $\binom{-}{+}$, etc. Of these six probable cases only the cases of (+), (−), $\binom{+}{+}$, and $\binom{-}{-}$ were taken into consideration, the third and fourth being counted as one (+) and as one (−), respectively.

For each of the five columns in Tables 1 and 2 the positive and negative cases were summed and the results are as follows:

Lows with velocities decreasing.	F.	R.	RF.	FL.	RL.
Number of + cases	25	20	16	34	10
Number of − cases	23	23	33	15	39
Ratio	(+)1.09	(−)1.15	(−)2.06	(+)2.26	(−)3.90
	(−)1.00	(+)1.00	(+)1.00	(−)1.00	(+)1.00

Lows with velocities increasing.	F.	R.	RF.	FL.	RL.
Number of + cases	61	50	60	26	84
Number of − cases	48	57	49	79	31
Ratio	(+)1.27	(−)1.14	(+)1.22	(−)3.04	(+)2.71
	(−)1.00	(+)1.00	(−)1.00	(+)1.00	(−)1.00

The ratios were so formed for the numbers of negative and positive cases that the smaller number of cases was taken as unity. Comparing these ratios for the cases of the lows of accelerating velocity and of those of decreasing velocity we see that the character of the ratios for F and R is the same, but that for RF, FL, and RL it is opposite. What does this mean?

(1) The areas of *fall*, whether they precede lows with *increasing* or *decreasing* velocity, seem to have in *more* cases a tendency to move with *accelerating* velocity than with decreasing velocity; the opposite seems to be the case for the areas of *rise*. That would suggest (if I can put any reliance on the slight excess of the percentage) that there seems to be no causal relation between the velocities of the lows and those of the accompanying areas of rise and fall.

(2) As to the RF, we see that the change of the distance corresponds with the velocity of the low in the majority of cases.

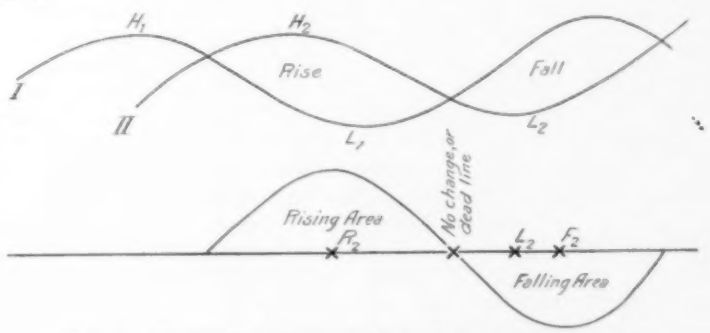

FIG. 2.—Curves of pressure and of changes of pressure.

(3) The character of the changes of RL and FL is opposite; if the low increases in velocity then, in the majority of cases, the distance FL decreases and the distance RL increases, the opposite being true for the lows of decreasing velocity. This result is plain and could be derived *a priori* from the study of the pressure change charts by any one familiar with their construction. I will explain it as follows: imagine a pressure chart; draw a line connecting the low and its following high,

and draw in rectangular coordinates pressure, Y, as a function of the distance (between the low and high), X, then we get in general a sinusoidal curve as in fig. 2. Suppose, now, that the whole system of isobars should move, for instance, eastward for some hundreds of miles without changing the form or the mutual distances of the isobars. Draw this sinusoidal curve once more in the diagram. Plotting the differences of the ordinates we get a wave representing the area of fall and rise.

This figure shows in general why the distance RL is about two, three, or even four times as long as the distance LF; it explains also why LF is shorter and RL longer for the lows which moved a greater distance in twelve hours, that is, for those that moved with greater velocity as compared with those that moved with smaller velocity. The distance RF, i. e., the distance of the area of fall from the area of rise, is, according to fig. 2, equal to the distance HL, that is, the distance of the high from the low. The deduction (2) could, therefore, not have been inferred *a priori* as it implies a change of the form of the wave; namely, for lows with increasing velocities the lengthening and steepening of the wave between H_2 and L_2, that is in the rear of the low. This means, in other words, the steepening of the gradients in the rear of the low, and naturally also an increase of the velocity of the low. The opposite is true for the lows with decreasing velocity, namely, a shortening of wave length. Let us imagine, for instance, an atmosphere homogeneous and sharply defined on its outer boundary, so we can observe its surface. The changes of the pressure due to the progress of the lows and highs would present themselves as waves progressing eastward; the wave would lengthen with increase of the velocity of the low, and would shorten with the decrease of the velocity of the low.

Most curious to me seems the fact about the velocities of F and R mentioned under (1). It seems to indicate, as I already mentioned, that there is no relation between the *velocities* of the lows, the preceding areas of fall, and the following areas of rise. The tendency of the area of rise seems to be to move with *decreasing* velocity while moving after the low; *however the velocity of the low may change*, the character of the change of velocity of R seems to be unaffected by that of the low. I am inclined to believe that in the areas of fall and rise we have found something independent of the low, something primary, and that the low, by its distance from them, regulates its own velocity. I have, for my part, a view regarding these areas of rise and fall different from Ekholm's, which was mentioned in the introduction. I would bring those moving areas of falling and rising pressure in close connection with both the currents producing the lows, namely, the northerly cold winds with the areas of rise and the southerly warm winds with the areas of fall, because, first, the extreme temperature changes lie within the areas of rise and fall, and, second, these two currents are the primary cause which gives rise to the low.

Another problem is why there should be a majority of cases of increasing velocity for the areas of fall and decreasing for the areas of rise. I do not know what reason to offer for the first question regarding the falling area, but as to the second I would offer the following explanation. As mentioned above, I am inclined to associate the area of rise with northerly winds; these have their greatest energy of motion near their origin in the extreme northwest, and this energy decreases as they sweep over the plains southward.

Hitherto, in treating the areas of fall and rise, I have considered only the movements of their centers, that is, the points of greatest change in pressure, negative and positive, whether they occupied the central part of the respective areas or were unsymmetrically placed. I have given, as I might say, the kinematics of these points, L, R, and F.

The next question I took up was the following:

On outline blank maps I put for three successive readings the positions of the centers of lows, the positions of the centers of the areas of fall and rise, and then drew the lines of zero pressure change, which I will shortly call "dead lines." (These lines connect the places where the net change within the last twelve hours is 0.) Having drawn them thus for three successive observations at intervals of twelve hours, I could study how the dead line in front of RA advances with the low, how the contour of its front changes, and how the surface of the area of rise is distributed on both sides of the track of the low.

I have constructed such maps for all of the 170 lows considered, but found that only those could be of some use to me where the paths of the lows were in the middle Mississippi Valley States, so that the extensions of the areas of rise and fall were within the limits of the map.

Upon these charts I tried to compare with each other those lows where the changes of the velocity of the lows for two successive periods of twelve hours were nearly opposite. As examples, consider the eight maps appended as lithographic Charts VIII–XV, in connection with the following remarks:

Group I.
- *For increasing lows:*
  - March 11, 1899, a. m., track V, velocity increasing from 234 to 590 miles.
  - March 7, 1902, p. m., track III, velocity increasing from 0 to 640 miles.
- *For decreasing lows:*
  - March 25, 1901, p. m., track VII, velocity decreasing from 550 to 120 miles.

In the first two cases we find that during the first twelve hours the dead line gained ground on the left side of the track of the low; and in the second twelve hours the advance of the dead line is limited to the right side, while the line on the left side retreated. The center of rise of pressure in the map first considered crosses at an acute angle to the right side of the low; but this is not so in the second case, where it remains on the left.

In the third case (the decreasing low) the front of the dead line is during the first twelve hours farther advanced on the right side of the path of the low, but in the next twelve hours it crosses from the right to the left side of the track, while the center of the rise crosses also from the right to the left side of the low.

Lows with decreasing velocities.

Group II.
- March 6, 1900, a. m., track III, velocity decreasing from 708 to 400 miles.
- January 6, 1899, a. m., track II, velocity decreasing from 885 to 610 miles.
- December 2, 1902, p. m., track I, velocity decreasing from 617 to 470 miles.
- December 3, 1893, p. m., track I, velocity decreasing from 828 to 320 miles.

In the first case the front of the dead line advances in about a north-northeast direction, fairly symmetrically with the track of the low, while the center of rise on the left side approaches the track of the low and follows it pretty closely. In the second case the front advances much farther on the left side than on the right side; the track of the center of rise approaches the track of the low and keeps on the left. In the third case the front is perpendicular to the track of the low, and in the fourth case we find again a greater advance of the dead line on the left side than on the right side.

Low with increasing velocity.

Group III. January 5, 1893, a. m., track III, 370–800 miles.

The front of the dead line keeps ahead on the right side of the track of the low, while the track of the center of rise is on the right side.

In this way I could go on to describe many series of maps

that are similar in their features to those here taken into consideration. If we summarize the deductions above we may say:

I. The lows that move with accelerating velocity are in general characterized by the greater advance of the front of the dead line on the right side of the track of the low than on the left; the track of the center of rise keeps either on the right side or crosses to that side from the left at an acute, a right, and even an obtuse angle.

II. The lows that move with decreasing velocity are characterized by having the front of the dead line perpendicular to the track of the low or with a greater advance on the left side, the track of the center of rise keeping in most cases either on the track of the low or very close to it, usually being on the left side or sometimes even crossing from the right to the left.

In a similar way we could study the dead line in the front of the area of fall and the movements of the centers of the areas of fall as I have done above. If we look through a series of maps of the character described above we find that the centers of the areas of fall generally precede more or less closely the centers of the advancing lows and are no doubt fairly good indicators as to how the lows will move in the next twelve hours, but their relations to the lows on account of their proximity appealed to me less than the characteristics of the areas of rise and their centers.

* * * * * * *

In presenting this short study on areas of rise and fall I can not close without an appeal to those who *see* and *read* better than the writer of this article the daily maps showing the changes of meteorological elements, and to whom, perhaps, part of what has here been said does not appear as something new. The drawing of this kind of charts, which has been done at Washington for a long series of years, and their use for forecasting in the hands of expert forecasters have certainly given rise to many empirical rules about the relation of the "dead line" to the areas of fall and rise, but so far as I know these rules have never been presented for publication to be used by others also and to be interpreted by those who have gained a deeper knowledge of the dynamical nature of cyclones and anticyclones. So with the retirement of a forecaster all of his empirical rules on weather forecasting are lost without becoming the property of practical meteorology. How, then, can one expect an advance in forecasting?

These empirical rules should become the general property of meteorology and should be published, not only for the mutual help of forecasters, but also in the interest of meteorology as a science, even if the forecaster himself can not give a physical explanation of the rules found and used by him.

We draw and write about types of weather; why should we not in a similar way treat pressure, temperature, and other charts? The practical forecaster looks at the weather map with a different eye from the scientific meteorologist, and probably many of the empirical rules of the forecaster can be given a physical explanation by a scientific meteorologist. On the other hand a physical law may receive a practical application in the hands of an expert forecaster.

As an example of this I call attention to the paper of Mr. Bowie, published in the report of the Peoria Convention of Weather Bureau Officials,[6] where he expounds a new method of determining the direction and velocity of the movement of a storm and shows that the direction and the amount of movement is a resultant of two forces, namely:

(1) The component of the eastward drift, (2) the resultant of the pressure "exerted on the storm center" (to use his own words) from all directions. He tries to find some simple, geometrical scheme for the expression of these two forces and thus to determine the track of the low.

I know not whether it was known to Mr. Bowie or not, but in reality his text does not say anything more than what is known in meteorology as Kœppen's law of the movements of cyclones, stripped of its physical and dynamic expression, and put in a simplified form applicable to weather forecasting.

That the application of the pressure change charts for weather forecasting is something new in Europe seems to be indicated by the lines of the paper of Professor Ekholm, who either intentionally omits any note on the use of the charts in the United States or else does not know about it. To prove that those empirical rules would be of great interest to many who have read Ekholm's paper just mentioned and have started on this study, I may refer to a note by Mr. Friesenhof (Meteorologische Zeitschrift, May, 1905), who grows quite enthusiastic over the advice of Professor Ekholm.

I therefore wish to finish with the remark that the empirical rules, based on long years of use of these charts in question, should form the subject of many articles in the MONTHLY WEATHER REVIEW for the benefit of practical meteorology, which is to-day based *only* on them; their physical interpretation will give us a firmer basis for understanding the weather.

[6] For second edition see Monthly Weather Review, February, 1906, Vol. XXXIV, p. 61.—ED.

GLAISHER'S FACTORS AND FERREL'S PSYCHROMETRIC FORMULA.

By Prof C. F. MARVIN. Dated June 5, 1906.

An article in the Quarterly Journal of the Royal Meteorological Society, Vol. XXXII, No. 173, pages 35–45, January, 1906, by J. R. Sutton, gives a discussion of the differences between dew points and humidities as deduced from readings of the wet-bulb and dry-bulb thermometers by the use of Glaisher's tables of factors of reduction and Ferrel's psychrometric formula and tables.

The writer calls attention to large and striking disagreements in the results derived from these two tables under certain exceptional or extreme conditions, but he afterwards makes this significant statement, page 40:

> After all, there is not so much difference as one might expect between the monthly means * * * computed respectively by means of the Greenwich factors * * * and by Ferrel's psychrometric formula.

In illustration of this the mean hourly values for the months of March and November, 1904, respectively the wettest and dryest months, are compared, from which it appears that the mean dew-point for March, by Ferrel, was 0.5° higher than by Glaisher's factors; whereas, for the dry month of November the mean dew-point by Ferrel was 2.6° lower than by Glaisher. In all these observations the wet bulb was subjected to only such ventilation as resulted from the motion of the natural wind. The kind of screen or thermometer shelter employed is not mentioned. In order to make the comparisons the more fair, however, Sutton has applied an empirical correction to the wet-bulb readings, based on the wind velocity observed 40 feet above ground for half an hour before each reading.

In any discussion of the relations and discordances between psychrometric formulæ, it is highly important to keep clearly in mind: 1st. That the psychrometric formulæ commonly employed, even at the best, only approximately express the law of relation between the wet-bulb temperature and the moisture content of the air. 2d. That the numerical coefficients of these formulæ are necessarily computed from certain tests observations which, unfortunately, are always comprised between far too narrow and restricted limits. It is a comparatively easy matter, for example, to make many thousands of simultaneous dew-point and wet-bulb determinations and compute therefrom the coefficients of a psychrometric formula; of these observations, however, relatively a very few will com-

prise properly combined extreme conditions of temperature, pressure, and dryness. The result will be that a given psychrometric equation may possibly be made to fit the ordinary range of atmospheric conditions very well, whereas the formula is very likely to be weak and unreliable in its application to extremes of either temperature, pressure, or dryness.

It seems to the writer to be well recognized by all experienced investigators that approximate formulæ, even when supposed to rest upon a more or less rational basis, can be depended upon only within the range embraced by the observations from which the coefficients of the formulæ were deduced. Extrapolation, to any considerable extent outside this range, is almost certain to involve more or less serious errors.

The foregoing considerations afford, I think, an entirely satisfactory explanation of the very radical differences between Glaisher and Ferrel pointed out by Sutton. Thus, for the observed air temperature 50° F., wet-bulb temperature 34° F., we get the dew-point by Glaisher +17° F., but by Ferrel −1 ° F., etc.

It is quite likely that this example represents conditions quite outside of any of the actual test observations employed by either Ferrel or Glaisher.

These same considerations satisfactorily explain the fairly close agreement between the observations under ordinary conditions when reduced by the same two authorities, as illustrated in the computations of the hourly data for March and November, even though these be relatively extreme conditions. It is interesting to plot the March and November results, as shown in fig. 1.

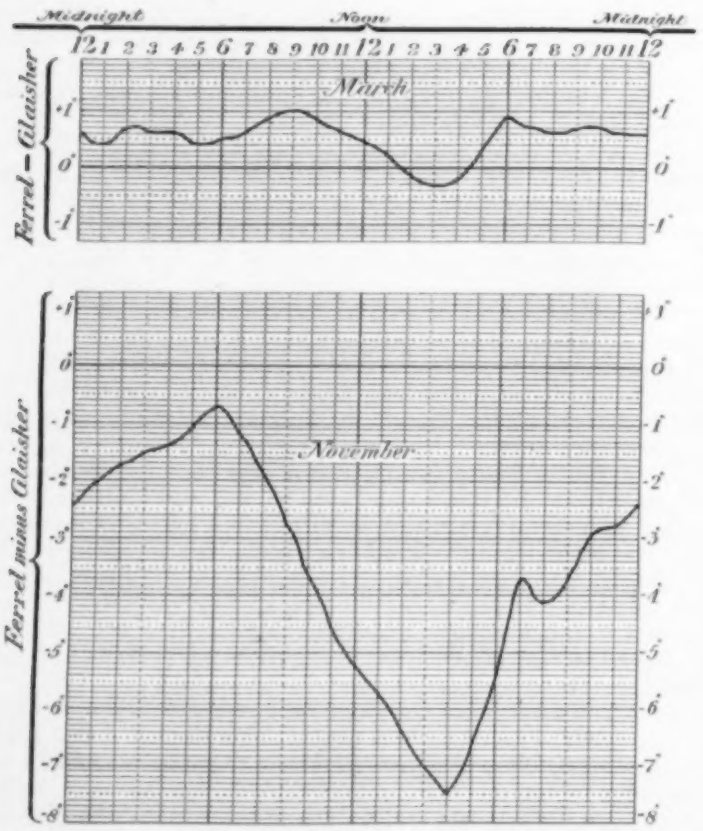

FIG. 1.—Differences between the dew-points computed by Glaisher's and by Ferrel's methods.

During March the air is relatively moist, except in the middle of the day, and the dew-points are almost perfectly constant. We must expect the results for such a month to agree closely simply because the coefficients of the psychrometric formulæ have been fitted to just such observations. It is fair to suppose that the fundamental data employed by both Ferrel and Glaisher[1] must agree pretty closely, especially for the ordinary atmospheric conditions, whereas, under more unusual conditions, as, for example, under the relatively dry conditions of the month of November, the differences are noticeably greater, although still not seriously discordant except in the middle of the day, when the humidities run down to nearly 20 per cent. As Sutton points out, Glaisher's equation admits of very great depressions of the wet bulb, with low humidities, whereas by Ferrel the humidity rapidly runs down to zero as the depression of the wet bulb increases. We think it is quite likely that if Glaisher's original data could be critically examined it might be found either that observations under extreme dryness are few in number or that the adopted factors do not fit these observations very well.

It would seem that the interpretation of Ferrel's formula in empty space requires a different statement from that given by Sutton who concludes that the wet-bulb reading would fall to absolute zero. If the idea of "empty space" involves the necessity that the vapor pressure e is zero, as well as the air pressure P, we must conclude that no water can be present on the wet bulb, at least no vapor may be given off, and hence no cooling could ensue. In fact, the argument amounts to an attempt to fit the formula to irrational conditions, and the result is indeterminate. A more rational basis of analysis is to assume that the pressure in such a space is only that due to the vapor present, that is, $P = e$, whence

$$e = \frac{e'}{1 + A\,(t - t')\left(1 + \dfrac{t' - 32}{B}\right)}$$

which is an entirely rational result.

The coefficient A, however, is a function of the rate of diffusion of vapor from the wet bulb and also of the coefficients of conduction and radiation of heat.[2] It is not to be supposed, therefore, that the same numerical value of A, found to suit ordinary atmospheric conditions, would suit the extreme conditions of the present assumption, under which the conduction of heat to the bulb and the diffusion of vapor from it are so radically different.

So much has been written demonstrating the necessity of using some degree of uniform ventilation for the wet-bulb thermometer, that we know for a certainty that unsatisfactory ventilation can only result in accumulating observations that are affected by many irregular errors. The plan worked up by Sutton, of using a series of corrections to the wet bulb depending upon the wind movement, is very tedious as well as only approximate. The wind movement ought to be measured at the wet bulb, not at "40 feet above ground". Very few observers could be expected to deduce properly such a series of local corrections, and corrections found suitable at one observatory could hardly be safely employed elsewhere, unless the conditions of exposure were substantially identical. Some form of aspiration fan, such as employed by Assmann in certain forms of recording apparatus, is necessary for continuous observations.

Glaisher's factors do not appear to be founded on any physical basis, whereas Ferrel's equation expresses practically all that is at present known respecting the psychrometric law as

[1] The observations employed by Ferrel were specially made for the purpose by Professors Hazen and Marvin, and comprised as great a range of conditions as possible. These are fully given in the Annual Report of the Chief Signal Officer for 1886, p. 233, et seq.

Glaisher states that his factors are based on a large number of dew-point observations, but the writer is not aware that these have been published.

[2] Recent Advances in Meteorology. Ferrel. Ann. Rept., C. S. O., 1885. Part 2, p. 387. See also Meteorological Apparatus and Methods. Abbe. Ann. Rep., C. S. O., 1887. Part 2, p. 371.

dependent upon the diffusion of vapor from a wet bulb and its gain or loss of heat by conduction, radiation, etc.

While such "factors", carefully determined, may give very satisfactory results over a limited range of conditions, yet when we are called upon to choose between distinctly discordant results under more or less unusual conditions, such, for example, as those given by Sutton for November, it would seem the argument is entirely in favor of Ferrel.

The great source of unreliability in existing psychrometric tables is the insufficient or unsuitable experimental basis from which to compute the psychrometric constants. Many thousands of observations have been made and used for this purpose, but when they are subjected to critical analysis thousands of them are found to fall within a narrow range of moisture and temperature conditions, while very few cover those extreme combinations of temperature, wet-bulb depression, and pressure that are required in order to ascertain what values of the psychrometric constants are suitable for the wide range of conditions that is usually embraced in such tables.

A special source of error in psychrometric tables lies in the determination of the fundamental dew-point by means of the condensation hygrometer or dew-point apparatus. The instruments as delivered by the manufacturers, whatever may be their name or form, are all fundamentally bad, and physically objectionable for the following reasons: (1) There is an unnecessary mass of material to be cooled to the dew-point; (2) an adequate supply of refrigerant is not provided for; (3) the idea that the conduction of heat to the chilled surface should be cut off as far as possible, appears never to be taken into consideration by the maker, (this defect is, however, a fruitful source of unequal temperatures and consequent errors, and causes a waste of refrigerant and effort); (4) the free space provided for the bubbling of the ether is always entirely inadequate in those instruments in which this refrigerant is employed.

When, in 1885, the writer undertook the dew-point determinations for the Weather Bureau he improvised the apparatus shown in fig. 2. The thin silver cup *a*, was taken from a so-called Regnault's dew-point apparatus. This was cemented upon an ordinary chemist's test tube, cut off at the lower end. A nicely fitting cork stopper carried a sensitive thermometer in a center opening, and two small lateral tubes of hard rubber. One of these, *b*, extended quite to the bottom of the silver cup, the other simply passed through the cork and a long rubber tube attached to its outside end served to carry the fumes of the refrigerant entirely clear of the apparatus.

A wooden, or cork-faced clamp supported the glass tube at a point well above the cup *a*. We realize in this construction (1) the minimum mass to be cooled; (2) the maximum relative supply of refrigerant; (3) a very satisfactory heat insulation; (4) a generous free space for the ebullition of the ether the cold fumes of which, as they ascend to escape, completely envelop the stem of the thermometer so that the bulb and the mercurial column have nearly if not quite the same temperature.

To secure accurate dew-point determinations by means of such an instrument the cup must first be highly polished and cleaned. For this purpose the writer has used a little oil and "putz-pomade." The rubbing motion is always longitudinally applied with the hand only. To clean off the grease the hands are first thoroughly washed in a copious lather of soap, discolored at first but finally snow-white, whereupon the cup and tube are cleansed in a similar lather worked with the hands. The clean soap suds are finally rinsed off in an abundant water supply and the apparatus withdrawn from the clean water. The glass surface will remain wet, but the silver will emerge from the water *absolutely dry and clean*. Possibly a single drop of water may adhere to the extreme bottom of the cup and may be removed by a touch of a towel which should be used to dry the glass tube, *but the surface of the metal cup must not be touched for any purpose, as the surface will be soiled and the deposition of the dew will be modified.*

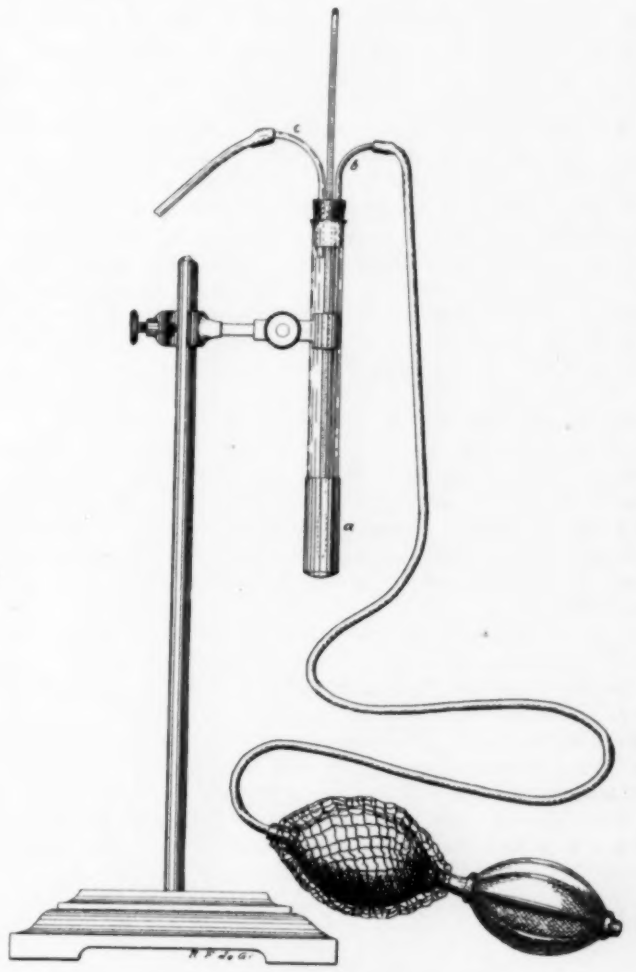

FIG. 2.—Dew-point apparatus.

This operation of cleansing the cup is difficult to describe in detail, but it is easy to perform and it must be employed every few days if the instrument is used regularly. Certain other precautions are necessary. (1) The place of observation must be selected with a view to securing (*a*) perfectly free ventilation, without any appreciable drafts, (*b*) the proper illumination. This is a troublesome detail. We must be able to see the surface of the cup. Its highly polished surface causes it to reflect any strong source of illumination. This must be cut off, as far as possible, as it causes us to perceive the strong illumination and prevents us from seeing the actual reflecting surface of the cup, hence we fail to see the minute incipient deposition of dew. In general, the instrument requires a well-lighted location in an inclosure with darkened walls which latter give a black surface as reflected from the surface of the cup. That is to say, by reflection the cup itself seems to be black and not of silvery whiteness. The slightest deposit of dew on such a cup can be discerned.

(2) The observer must exhale through a long tube. A provision for this purpose enables him to proceed deliberately with his experiments and permits of the most critical inspection of the surface of the hygrometer at short range with the minimum prejudicial influence due to his presence and without the discomfort of any restraint upon his natural respiration.

(3) The deposition of the dew must be produced in the fol-

lowing way: The tube is kept filled with refrigerant[3] to slightly above the level of the silver cup. The bulb of the thermometer is kept slightly above the mid-section so as not to be too near the air entering at the bottom. A preliminary cooling shows the approximate temperature of the dew-point. The cup is allowed to warm up a trifle, and the cooling is then made to proceed very slowly until the slightest possible deposition of dew appears, when the temperature is noted. The cup is again permitted to warm up a little by checking the cooling, but still maintaining a slight flow of air to prevent any too sharp changes of temperature and to keep the liquid thoroughly stirred. A second deposit of dew is formed and its temperature noted. In the meantime a gentle circulation of air in the vicinity of the hygrometer is maintained by means of a common fan. Owing to the small mass and good heat insulation of the instrument the temperature of the cup can be controlled admirably so as to cause dew to deposit and vanish at will and the temperature maintained nearly constant just at the dew-point for several minutes, thus affording several determinations.

If the observation is correctly conducted the difference between the temperatures at which the dew forms and vanishes, respectively, is too minute to be discerned by the thermometer in the liquid; at the same time there is generally an appreciable difference in successive determinations, just as there is a difference in the successive values of the wet and dry-bulb temperatures.

In the Colorado observations made by the writer on and near Pikes Peak, his practise was to make five readings of the dew-point, followed by ten readings on the whirled psychrometer; followed again by five dew-point readings. The sums of these respectively, with the decimal points properly placed, gave the numerical result of one experiment. Nearly 1000 experiments of this sort are incorporated in Ferrel's psychrometric tables as now used by the Weather Bureau. These tables are based on Ferrel's rigorous formula (20), page 249, Annual Report of the Chief Signal Officer, 1886, viz,

$$p=p_1-0.000660\ P\ (\tau-\tau_1)\ (1+0.00115\ \tau_1)\ \text{centigrade},$$

or,

$$p=p_1-0.000367\ P\ (\tau-\tau_1)\left(1+\frac{1}{1571}\ (\tau_1-32)\right)\ \text{Fahrenheit},$$

instead of his approximate expression

$$p=p_1-0.000660\ P\ (\tau-\tau_1)\left(1+0.00115\ (\tau-\tau_1)\right)\ \text{centigrade}.$$

[3] The writer finds Squibb's sulphuric ether about the best.

IMPROVEMENTS IN SEISMOGRAPHS WITH MECHANICAL REGISTRATION.

By C. F. MARVIN, Professor of Meteorology. Dated May, 1906.

About a year ago the writer began a series of experiments with a view to making improvements in seismographs such as are employed for the absolute or quantitative measurement and registration of the motions of the ground during earthquakes, especially in those instruments in which the registration is effected mechanically by a stylus tracing its record upon smoked paper.

The work has progressed rather slowly and with many interruptions incident to the discharge of other engrossing duties, and much still remains to be accomplished before we can feel assured that our seismograms are faithful reproductions in detail and to scale of the actual motions executed by the piers that support the instruments. Certain improvements, however, have now been tested so fully and with such satisfactory results, and the devices may be so easily attached to practically any form of seismograph with mechanical registration, as to warrant this short account of the work thus far accomplished.

Early in 1903 a set of the Bosch-Omori horizontal pendulums, with mechanical registration, were procured for the Weather Bureau at Washington, D. C., and one of these instruments at once installed. Owing to the lack of a suitable place of exposure, the other pendulum was not set in operation until July, 1905, and then only in a temporary location. More recently, however, both instruments have been reinstalled in a new location under conditions which are quite satisfactory, although still subject in a slight degree to the influences due to the immediate environment. The improvements about to be described have been applied to these instruments, one of which, in its original form, is shown in figs. 1 and 2, and was fully described in the MONTHLY WEATHER REVIEW for June, 1903, Vol. XXXI, pp. 271–275.

The steady mass C is considered generally to remain at rest during the earthquake. The forked short end of the lever L, fig. 2, engages the delicately pivoted pin f forming part of the steady mass C. This point of the lever therefore remains at rest. The motion of the ground is communicated to the lever at its pivot d, carried in the massive yoke piece G, which in turn is firmly secured to the ground or pier. It results from this disposition that lateral relatively quick vibratory motions of the ground will be registered in a magnified fashion as a sinusoidal curve by the long end of the lever L tipped with the stylus as shown enlarged at S, fig. 2. Assuming the reader to be already familiar with the main features of the operation of seismographs we shall proceed at once to the discussion of one of the chief sources of errors in these instruments, namely, friction. The steady mass of the seismograph, if slightly disturbed, will in general be very soon brought to rest by the unavoidable friction in the joints of its mechanisms. On the other hand, during an earthquake this same friction tends likewise to set the mass in motion. Indeed, very small earthquakes often fail to be recorded at all because the friction at the joints of the recording stylus in scratching off the soot literally forces the steady mass to move exactly with the ground, so that no record is obtained. The elimination of friction to the utmost degree is therefore of the greatest importance. Another source of error in the Bosch–Omori instruments that seemed to cause the loss of records of the very small vibrations was in the use of the forked end of the lever L and the pin f. The width of the forked opening could never be adjusted to fit the pin properly. There was always a little lost motion at this joint, or when the pin fitted exactly, the friction was excessive. In setting about to improve our instruments in this respect, one side of the forked arm of the lever was cut away entirely, and a very delicate hair spring of a watch was fastened to the pivot of the lever L so as to cause the short end of the lever to bear very gently against the pin f of the steady mass. The tension of the hair spring was adjusted so as to be just enough to easily scratch the soot on the record sheet. By the new arrangement the stylus is moved in one direction only by the force of the spring, whereas motion in the opposite direction is caused by the direct push of the pin f. This alteration led at once to three important discoveries.

(1) *Increased sensitiveness to short-period tremors.*—The instrument was now found to record minute short-period vibrations of the ground and pier to which previously it had never been in the slightest degree sensitive. The rapid driving of vehicles along an asphalt street about 90 feet distant caused a preceptible thickening of the trace, whereas a large record was made every time a wagon passed over a cobble paved private way only about 30 feet from the pier upon which the pendulum had been temporarily installed for the purpose of this study.

(2) *Improved method of marking time.*—The second valuable

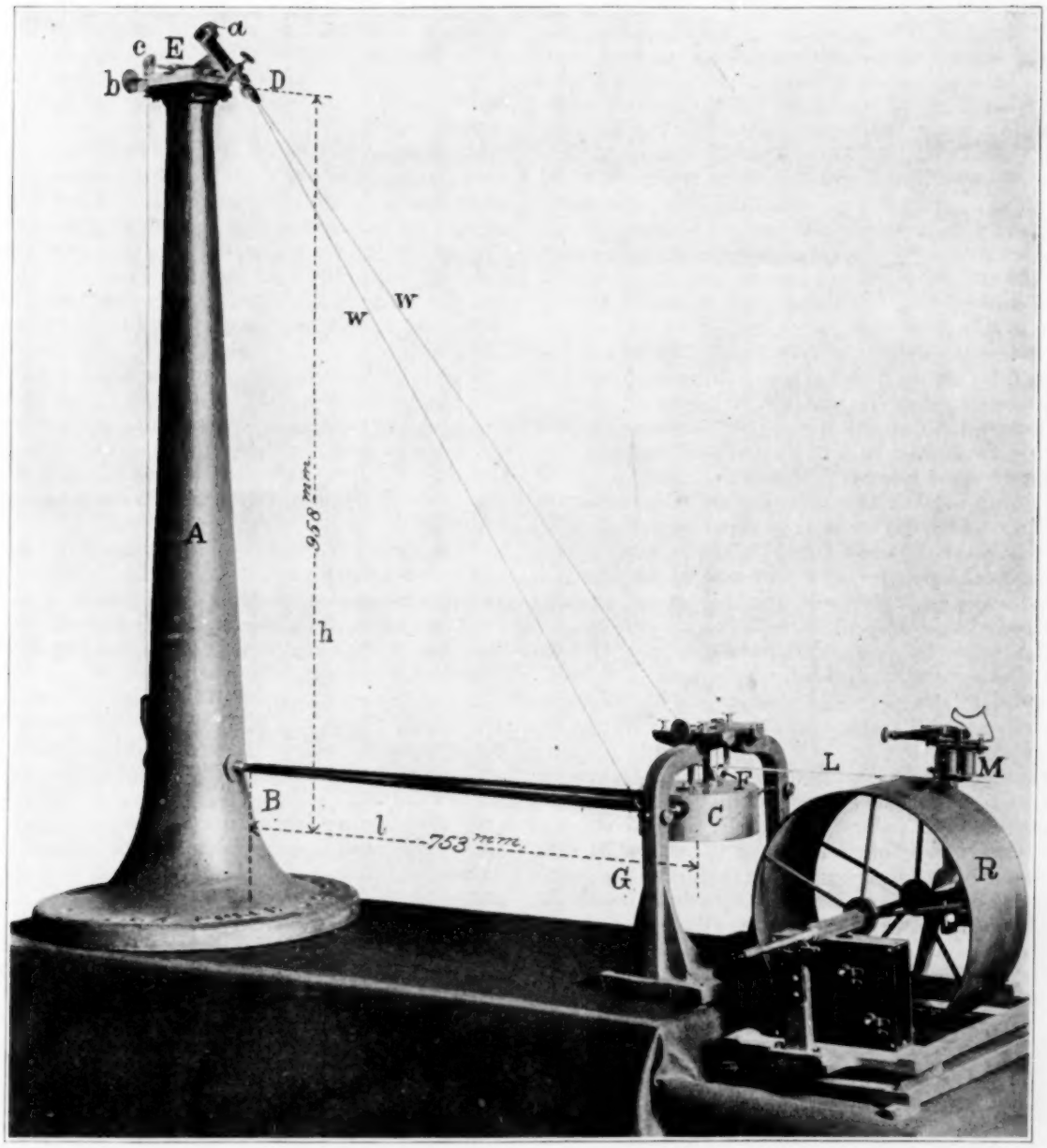

FIG. 1.—Bosch-Omori horizontal pendulum seismograph at Weather Bureau.

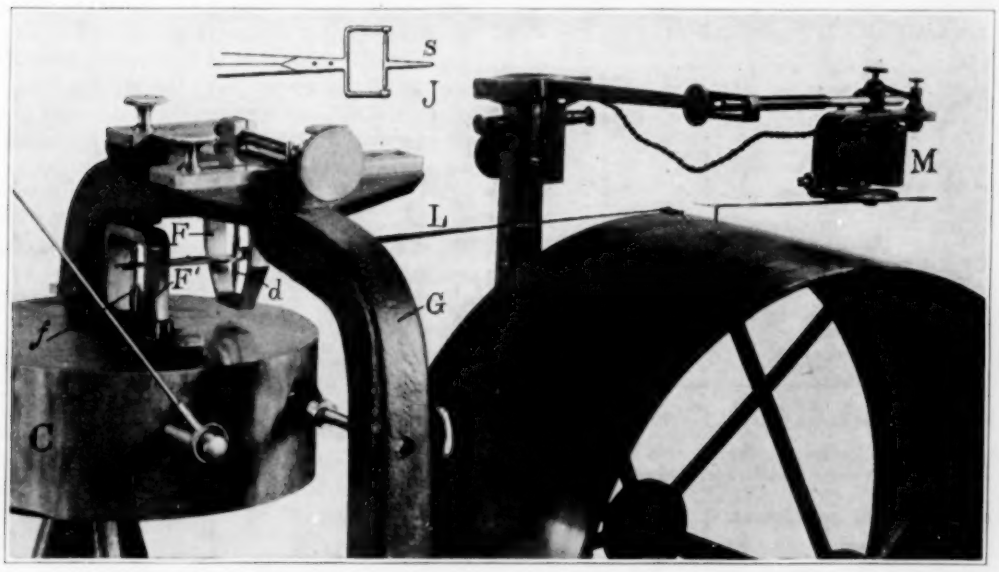

FIG. 2.—Recording and time-marking devices; original form.

fact discovered was that a very slight rap or blow delivered anywhere against the pier, or especially against the yoke piece *G*, would cause the lever *L* to momentarily recoil or kick away from the pin *f*. This provided a long desired method for causing the stylus to mark its own time on the record sheet instead of depending upon the separate time ticker *M* originally supplied. That is, it was found that by simply attaching the magnet *M* anywhere upon the yoke piece *G*, every snap of the armature against the poles of the magnet sufficed to make an excellent time mark on the record. Those familiar with these instruments know how impossible it is to determine accurately the time correction between the time ticker *M* and the point of the stylus, when the time is marked independently of the stylus.

(3) *Great reduction of friction by vibration.*—The third and perhaps the most interesting discovery was largely the result of accidental circumstances. It was noticed that at certain times now and then each day the lines of the seismographic record were visibly thickened in a comparatively uniform and continuous manner. This was soon traced to the influence of a small electric motor used in the machine shop in a distant part of the building, which set up minute short-period tremors in the building that were communicated to the seismographic pier. That is to say the pen lever was in a continual state of minute motion which was just easily visible to the unaided eye and which showed on the record simply by the thickening of the line. The valuable feature in connection with this observation, however, was that this vibratory motion reduced the effective friction at the pivots of the lever and the point of the stylus to only a small fraction of its amount without the vibration. I saw at once that it would be very easy to induce vibrations artificially and continuously by simple electrical devices. The steady mass and yoke piece of this instrument were at this time inclosed in an improvised pasteboard box to cut off air currents, and I found artificial vibrations of sufficient intensity could be induced by simply laying a small electric call-bell on the pasteboard box. The bell itself was removed and only the armature and clapper allowed to vibrate with a low humming sound and very feeble battery power (not exceeding one-tenth ampere). The results of these discoveries as affecting the records are reproduced in figs. 3 and 4.

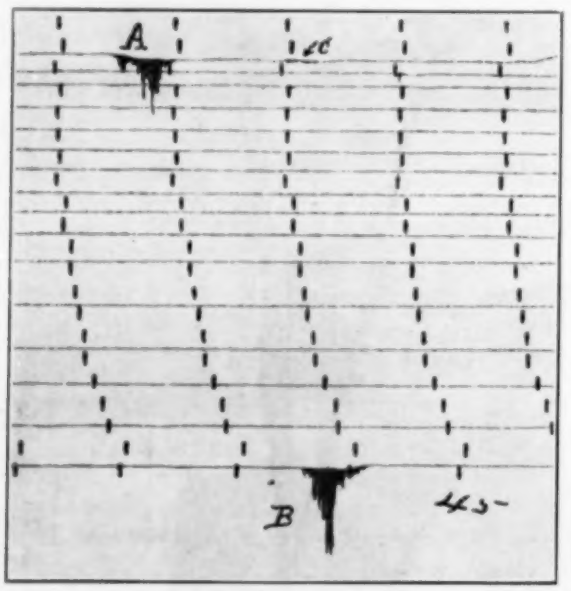

FIG. 3.—Portion of record of August 18, 1905.

A, *B*, are rapid kicks of the pen lever, caused by the passage of a wagon over cobblestone private driveway nearby. At *C* the line is visibly thickened by the minute tremors due to a light wagon driven over a smooth concrete pavement about 90 feet distant.

Lever L, and magnification.—The magnification of the record of the seismograph depends mainly upon the relative length of the long arm of the lever *L* and the distance from the pivot *d* to the pin *f*. The former can be determined very easily, but the writer has been repeatedly annoyed by the difficulty of ascertaining properly the distance from *d* to *f*. Even if this distance is once carefully determined yet changes from time to time are unavoidable and it seems vastly better construction to provide the short arm of the lever with a definite adjustable point that makes contact with a smooth projecting surface on the steady mass. By properly adjusting the position of the point the magnification can then be set at any desired amount and remains invariable. At the same time increased facility is secured in adjusting the position of the lever.

Stylus.—It is very desirable to be able to determine pretty closely the pressure of the contact of the stylus on the paper. For this purpose and in order to enable the stylus to return upon the record sheet when it is carried beyond the edge of the cylinder by large earthquake motion, the writer adopted the form of stylus shown in fig. 5 as it appears in its writing position in the end of the lever.

The pivot *f* is made by breaking off a bit of a fine sewing needle about .02 inch diameter and shaping the ends to fine sharp conical points. The stylus itself is made of a piece of fine aluminum wire, about .013 inch diameter; other kinds and sizes of wire have been tried, but the above is preferred. One end of a straight piece of this wire is carefully filed to a cone point of from 50° to 60°, fairly sharp but perfectly smooth and even. The wire is then given one turn around the pivot *f*, to which it is cemented by melted shellac or suitable strong wax. The long arm with the point slightly bent downward is made about one inch long. The short end must be cut off short enough to permit the marking point to be lifted from the record and turned over out of the way. A drop of wax, *d*, melted onto the short arm suffices to balance the stylus so as to give the desired pressure. This at first was computed from the known weight of the wire per unit length and other dimensions, but the process proved too tedious and I finally improvised a very simple balance for the purpose, composed of a piece of aluminum wire wrapped once around a bit of a steel needle to which it is cemented. Knife edges are not essential as the needle axis rolls on supporting straight edges very nicely. One end of the wire is flattened and a slight dimple or prick mark made at a measured distance from the axis. A bit of wire flattened at one end is hooked into this for a scale pan and the pen point stepped into the pan while the axis is held in a suitable fork as shown in fig. 6. Equilibrium of the balance is secured by a two or three milligram rider and its distance from the center measured. The pressure of the stylus is measured always with the long arm horizontal. The stylus is then allowed to swing free on its axis and the angle of depression ($=\sigma$) observed. In this position the pressure at the point would be zero. The pressure in any other position may be found by the equation

$$p = \frac{w}{\sin \sigma} \sin \theta$$

where θ is the angular amount the needle is lifted from its pendent position, w is the observed pressure when the needle is horizontal, and σ is the angle of depression of the needle when poised free. A pressure of over one milligram is generally greater than necessary. A half milligram is, however, scarcely sufficient, except for very fine lines on thinly sooted paper.

The position of the short arm of the stylus, as seen in fig. 5, is such that if the stylus passes beyond the edge of the record cylinder the point drops only a slight distance below the level of the surface of the drum. The edges of the drum have been

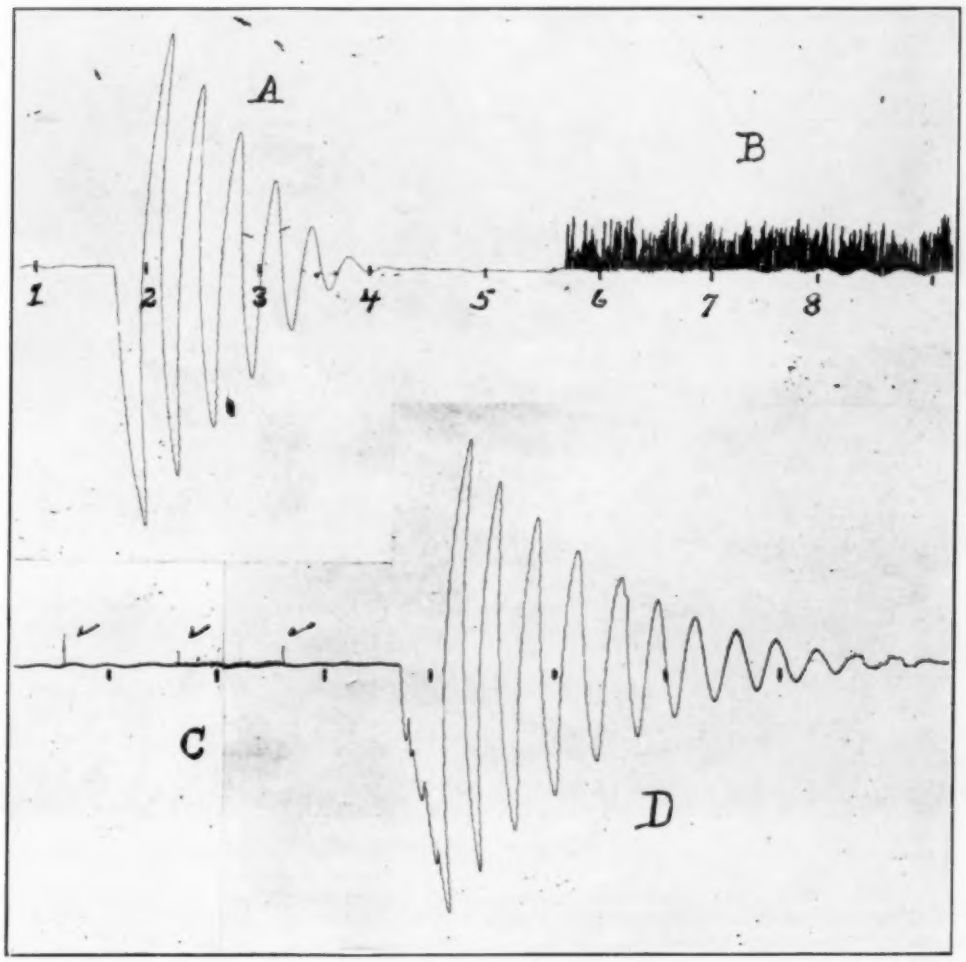

FIG. 4.—Showing effects of improved mounting and vibrator.

Trace *A*, normal action of instrument without vibrator. *B* shows rapid lateral pen strokes due to exaggerated influence of vibrator, when adjusted to synchronize closure with movement of pen lever. *C*, similar effect on relatively minute scale, amounting simply to slight thickening of line. *D* is tracing drawn by pen under influence of vibrator. The more numerous waves in *D*, as compared with *A* (4 to 8), show greatly diminished friction due to vibrator.

The ordinary time marks are shown at "1," "2," "3," etc. The time strokes made by the pen itself are shown by the check marks at *C*.

reinforced and beveled beyond the margins of the paper so that when the stylus, after having passed beyond the edge, returns, the point first strikes on this beveled formation so as to lift the point up onto the cylindrical surface. The margin of the paper, even if closely fitting the drum, sometimes obstructs the return of the pen a little, especially if thick paper is used; but we have found this arrangement of the pen to operate admirably in great earthquakes. Little or no loss of record occurs when the pen passes off the sheet.

The writer is strongly opposed to the use of stops limiting the relative motion of the steady mass and pen levers except at points entirely outside the limits of the record sheet. During heavy earthquakes the steady mass may remain sensibly at rest. If, however, stops are set with a narrow limit of motion, the large displacement of the ground causes these stops to butt into the steady mass and set it into violent motion, which subsides only after a considerable time, thus rendering a large portion of the record valueless. The simple passing of the pen off and on the sheet over the beveled edge of the cylinder may cause some loss and errors in the record, but the steady mass is disturbed only to a minimum extent.

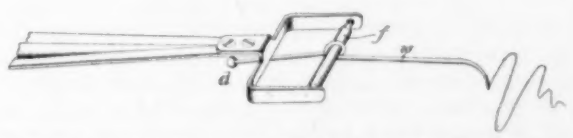

FIG. 5.—Aluminum wire stylus in writing position.

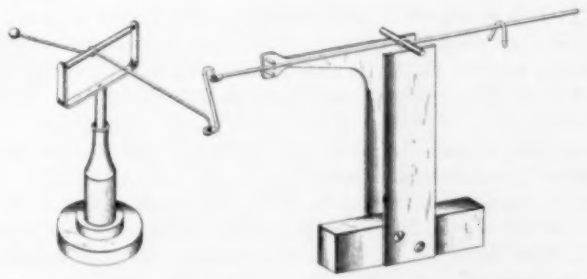

FIG. 6.—Improvised balance for weighing the pressure exerted at the point of pen.

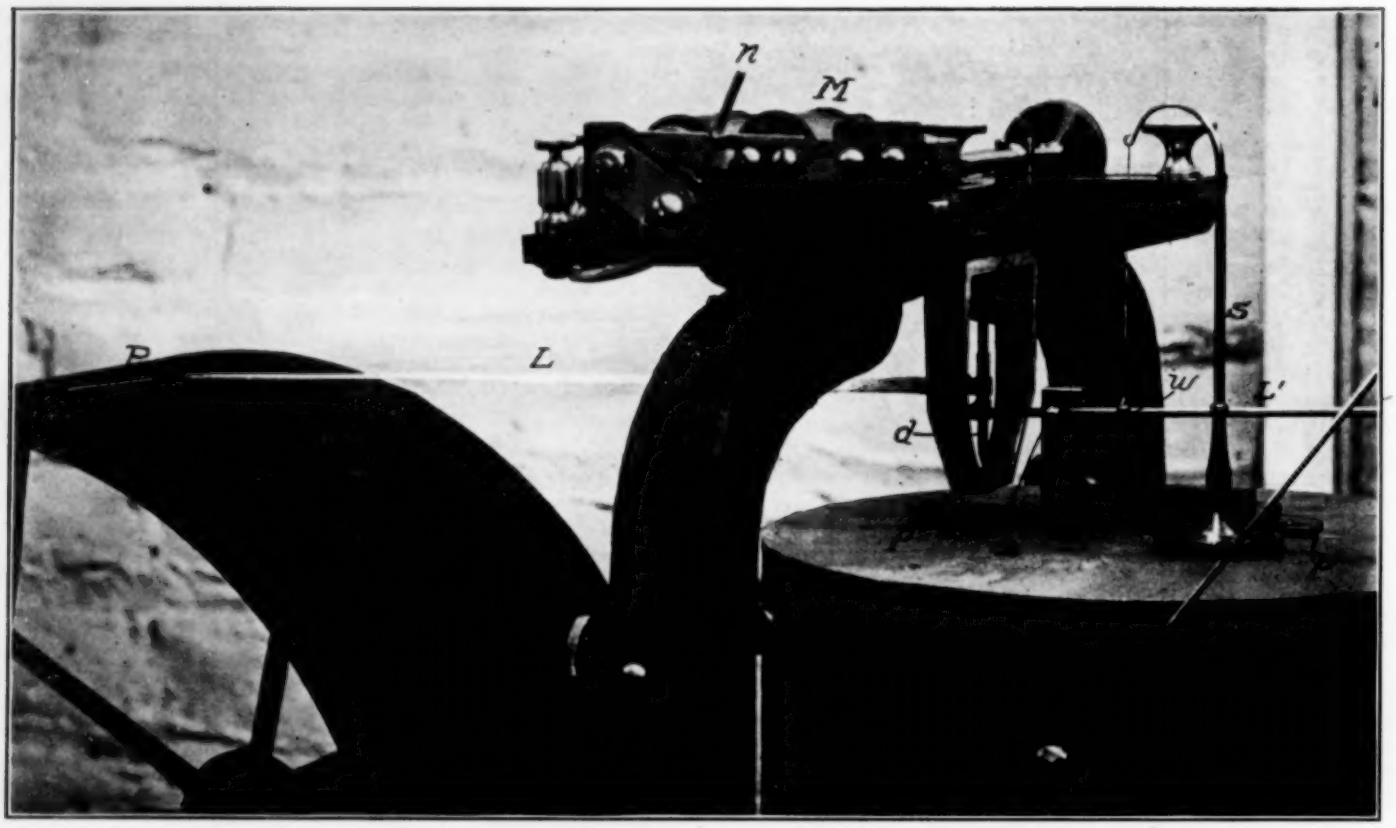

FIG. 7.—Improved multiplying, recording, and time-marking mechanism on the Weather Bureau seismograph.

The details of the recording mechanisms of the Bosch-Omori seismograph in its improved condition are shown in fig. 7. The multiplying lever LL' is carried as before on the sharp pointed, pivoted axis d in the adjustable stirrup F. The latter is rigidly secured to the supporting pier by the massive yoke piece G. The original forked, short arm of the lever, as shown in fig. 2, has been replaced by the extension L', which consists of a slender steel rod, the weight of which very nearly balances the whole lever on its axis.

It may be well to state here that the following conditions require to be satisfied in the design and construction of the multiplying levers of the seismograph:

(a) In order to avoid unnecessary friction at the pivots, as well as for other reasons, the mass of the lever must be the minimum consistent with adequate strength and stiffness.

(b) The lever must be balanced on its pivots for two reasons: First, because the friction will, in general, then be less; second, to render the lever neutral to earthquake motion, for if not balanced, it would tend to oscillate about its own center of percussion when subjected to earthquake motion and thus introduce a complication in the behavior of the seismograph that is absent when a balanced lever is used.

(c) The moment of inertia of the lever should be a minimum, so that it may respond promptly and accurately to short-period vibrations and so that the reaction at the steady mass required to produce the forced oscillations of the lever may be a minimum.

These requirements are incompatible in certain respects, and some compromises are necessary. A very light lever of minimum mass and moment of inertia can easily be made of adequate strength, but it will not be balanced; the long arm will be too heavy. If now we balance by adding a heavy counterpoise close to the axis, we get a smaller moment of inertia than if a lighter counterpoise at a greater distance from the axis be employed. In this latter case, however, the friction is less. It can easily be shown that with ordinary light multiplying levers and the relatively slow-period motion of ordinary earthquakes the second requirement under (b) and also that under (c) are relatively unimportant details, and the writer has found that the form of lever shown in fig. 5 exhibits less friction at the pivots and is otherwise better than heavier levers of less moment of inertia. Moreover, such a lever is found to recoil better, that is to kick off in the desired manner under the action of the time-ticker magnet M, so as to produce the time marks on the record sheet. The lever is not quite balanced. The extension L' is not exactly on the line of centers, but is thrown off slightly so that the pointed end of a small projecting pin attached at a may fall on the line of centers. This lack of balance appears to be necessary to give a large recoil with a very light tap of the magnet, but I have not yet had an opportunity to examine this point fully.

The projecting pin at a rests very lightly against the angle F', which is securely attached to the steady mass C, but may be adjusted thereon by sliding upon the metal strip pp'. The portion of F against which the pin a presses is faced with a thin plate of glass.

In order to keep the pin a pressed against the steady mass, I now employ the small weight w, hung by a silk fiber from the small adjustable stand s, which rides on the steady mass.[1] The weight w should press against the lever L' as close as

[1] This is simply an elegant little device for the purpose, producing, as it does, a practically constant contact pressure over a wide range of positions of the lever L. It is quickly adjustable and invariable with time or change of temperature. I borrowed this idea from a new Bosch-Omori seismograph received at the Weather Bureau a few months ago, after the other improvements described in this paper had been incorporated in one of our pendulums. I regret that I do not know the name of the real inventor of this very useful device.

practicable to the point *a*. It was set at one side in the photograph to show more clearly.

I first employed a spiral spring on the axis *d* to hold *a* in contact with *F'*. The pressure of contact is not constant with different angular positions of the lever, and it is not easy to adjust such a spring minutely. I also tried a slightly unbalanced lever with the axis *d* tilted a little, in the proper way, to make *a* bear slightly against F'. This hardly admits of easy variations and nice adjustments. I considered, but rejected, the plan of maintaining *a* and *F'* in slight contact by mutual magnetic attraction. The contact, once broken, would not be automatically restored, which is a necessity in the process adopted for making time ticks.

The aluminum wire stylus, with its wax counterpoise, is clearly shown at *P* and *e* in the picture; the bevel on the edge of the cylinder is very imperfectly shown, however.

The ratio of the lengths of the two arms of the lever is at present set at 15 on this instrument. It is sensibly invariable, despite any adjustments which may be made of either *F* or *F'*.

Vibrator and time ticker.—This attachment is shown at *M* and is made over from the magnets of an ordinary small electric call bell. The magnets are rewound to a resistance of from 12 to 15 ohms. The bell and striker are dispensed with. The whole device is mounted on a stud that is simply fitted closely into a hole drilled into the yoke piece *G*. The two terminals of the coils are brought out directly to two binding posts. A third post is put in connection with one terminal through the vibrator. A single dry cell (voltage 1.4) is put on this circuit through the vibrator and causes the armature to vibrate with a low musical hum. A little lever, split so as to embrace the free portion of the contact spring on the armature, serves to alter the period of vibration somewhat.

It seems that very feeble action of the vibrator is able to set up microscopic tremors in the massive yoke piece, *G*, sufficient to keep the whole lower arm, *L*, in sustained movement, so that friction is greatly diminished and other desirable effects produced, as has already been explained.

In order to mark time it is necessary, or at least preferable, to stop the vibration of the armature for a second or two, then to cause the armature to strike a sharp blow by sending, for a fraction of a second, a current of proper strength directly through the magnet. On the instruments at the Weather Bureau the time is marked as follows: At the 30th second of each minute the standard time-keeping clock electrically releases momentarily the train of a secondary clock in the seismograph room. A slight movement ensues and cuts off the current to each vibrator. After exactly two seconds the secondary clock is again released momentarily and this time a strong current is sent momentarily through all the magnets joined in series, thereby causing the recording levers to simultaneously produce time marks. As the cycle of actions is completed on the separate instruments the strong current is cut out and the vibration again started. The apparatus seems more or less complicated in the description, but in reality it is relatively simple enough.

Smoking flame.—In smoking the record sheets the recording cylinder is mounted on the iron support furnished by the manufacturer. Over this is an ample iron hood connected directly with a chimney flue to carry off the excess smoke. The best form of lamp I have thus far tried is made with a flat lamp wick about 8 inches long by 1½ inches wide. A piece of tin a little longer than the wick and not quite so wide is bent longitudinally through the middle into a U-formed trough. The ends are closed by pinching together, or otherwise, and the whole is secured to a plate or other device to make the open edge stand up. The wick is folded longitudinally through the middle and inserted in the trough with the free edges projecting slightly and equally above. Kerosene or other oil is applied to the wick from an ordinary machinist's so-called "squirt can". In order to lessen the tendency of the flame to flutter and burn unevenly, I set up beside it, and about one-half inch or less distant, a flat plate of stiff sheet iron. This rises beside the flame to within a half inch or less of the recording drum. The ascent of heated air across this plate produces a more even flame than without the plate, which, moreover, I think tends to chill the flame and increase the volume of soot.

Paper and varnish for records.—The writer has found serious objections to the glazed paper commonly furnished and employed for record sheets, because it is too opaque to readily give photographic prints of records. It tears easily and the glazed coating is greatly affected by moisture, often causing the paper to curl up in the most unmanageable fashion. Finally, the soot coating very easily flakes off the glazed surface whenever a record is handled much, often defacing it in the most serious manner. A thin, smooth bond paper is vastly superior in point of durability, transparency, etc., but the lines are not quite so clearly visible by reflected light, as in the case of records on glazed paper. The sheets, however, remain flat and are much easier to file away.

The writer uses a celluloid varnish made as follows:

Thirty grams of transparent sheet celluloid is cut into narrow strips, which are then sharply bent at many points and thus crumpled up. These are placed in a large bottle (not less than two liters); 300 cubic centimeters of acetone is then added. After some hours with occasional shaking, a thick, viscous solution is formed. From 1500 to 1800 cubic centimeters of amyl acetate is then added and thoroughly mixed. A small portion of this is poured into a shallow tray, the top edges of which are ground true and flat in order that the tray may be closed practically air-tight by a small plate-glass cover. Such a tray, I find, prevents any appreciable waste of varnish and loss from evaporation. Sheets are varnished only on the smoked surface by passing it in contact with the liquid in the tray, while the sheet is held by the hand at each end so as to form a deep J-formed loop. The sheet is drained for a moment over the tray and dried while stretched horizontally between hooks, with the face downward to keep off dust.

The foregoing details relate to improvements that may, perhaps, be adapted to almost any seismograph with mechanical registration. I desire, in a second section of this paper, to discuss in a general way the dynamic characteristics of the more important seismographs now employed, with a view to indicating or contrasting their merits and defects.

WEATHER BUREAU MEN AS EDUCATORS.

Mr. George Reeder, Columbia, Mo., under date of May 17, 1906, referring to his regular course in the University of Missouri, states that the course included twenty lectures, and, as briefly described in the University catalogue, embraced the following subjects: (1) The earth's atmosphere—its composition, temperature, pressure, and circulation—dew, frost, clouds, rainfall, cyclones, thunderstorms, and tornadoes. (2) Weather and climate. Instruction under this second head included, among other topics, a discussion of the distribution of temperature and precipitation, the influence of winds upon climate, climate and weather, climate and health, comparison of climatic conditions at well-known health resorts of the world, weather records and health statistics, weather forecasting.

Charts, blackboard diagrams, photographs, and lantern slides were used to demonstrate the lectures; observations, written exercises, and laboratory work were required. The class consisted of nine students—eight medical and one agricultural. (Medical students are now required to take the course.) Each member of the class displayed great interest in the entire course, and the final examination was sustained in a very creditable manner.

Other work along the aforementioned lines during the first and second semesters was as follows:

Five informal talks on meteorology, instruments, etc., to mixed classes of University students that visited the office from time to time.

One lecture, on "Instruments and Methods used in Determining Climatic Conditions and Changes", to a body of visiting State teachers.

One lecture, on "Applied Meteorology", (illustrated) to the society of senior and junior engineers, University of Missouri.

One lecture, on "Practical Weather Forecasting", to the class in physics, Columbia High School.

One lecture, on "Applied Meteorology", (illustrated) before the "Scientific Association of the University of Missouri".

Mr. W. A. Shaw, Northfield, Vt., under date of April 16, 1906, reports that he has just completed a course of instruction in meteorology given to the senior class in Norwich University. This course covers a period of two hours per week during the winter term of twelve weeks. Waldo's Elementary Meteorology is used as a text-book for the foundation of the course, which is much amplified by reference to other standard works, maps, charts and publications of the Bureau. Special attention is given to the utility of meteorological reports, publications, and forecasts. He has given this course for the past ten years. It is a required study for all members of the senior class, who must pass a satisfactory examination in it as a prerequisite for graduation.

The college has recently purchased a Bausch & Lomb projection and photomicrographic apparatus of high grade which has been placed at the disposal of the observer so far as it can be utilized in his work. It is planned to use this equipment in work on snow crystals, clouds, lightning, and in making lantern slides of maps and charts to illustrate lectures on meteorology.

Mr. Shaw has been informed by President Spooner that in recognition of his work he has been made a member of the faculty, with the title of Professor of Meteorology.

Mr. A. H. Thiessen, Raleigh, N. C., under date of April 11, 1906, reports that he has just finished a course of lectures on meteorology and its applications, delivered to seniors in agriculture at the State College of Agriculture and Mechanic Arts. The class numbered about ten students.

Mr. M. R. Sanford, Syracuse, N. Y., under date of May 31, 1906, reports that the course in meteorology at Syracuse University, instead of being confined to the second semester, will be extended so as to continue throughout an entire college year, and in addition to this occasional lectures will be given on the general work of the Weather Bureau.

The following lectures and addresses by Weather Bureau men are reported:

Mr. H. F. Alciatore, May 23, 1906, a public address in the auditorium of the Little Rock, Ark., High School; also May 29, 1906, before the University of Arkansas, Fayetteville, on "The Work of the Weather Bureau", with lantern slide illustrations.

Mr. E. H. Bowie, May 11, 1906, before the St. Louis, Mo., Railway Club, on "The Weather Bureau and its Relation to Transportation", with lantern slide illustrations. (The paper and many of the illustrations are reproduced in the Official Proceedings of the Club, Vol. XI, No. 1.)

Mr. Ford A. Carpenter, May 28, 1906, before the senior class of the San Diego, Cal., State Normal School, on "Meteorology."

Mr. M. R. Sanford, May 3, 1906, before the students and members of the faculty of Syracuse University, a lecture illustrated with lantern slides; also May 12, 1906, an address to the Principal's Council of Onondaga County, on "Meteorology in the Schools".

Mr. J. M. Sherier, May 3, 1906, before the Contemporary Club, of Davenport, Iowa, on "Weather Forecasts and Warnings", with lantern slide illustrations.

Mr. F. J. Walz, May 19, 1906, before the Louisville, Ky., Educational Association, on "The Weather", illustrated with lantern slides.

Classes from universities, schools, and academies have visited Weather Bureau offices, to study the instruments and equipment and receive informal instruction, as reported from the following offices:

Buffalo, N. Y., May 1, 1906, a physical geography class from the Central High School; May 8, a class from Buffalo Mount Mercy Academy; May 15, a physical geography class from the Lafayette High School.

Detroit, Mich., May 9 and 11, 1906, classes of High School students; May 26, Prof. C. A. Davis and his class in meteorology, from the University of Michigan, Ann Arbor.

Hannibal, Mo., April 12, 1906, a class from the South School.

Hartford, Conn., May 28, 1906, senior grade pupils of the Arsenal Grammar School.

Pensacola, Fla., May 28, 29, and 30, 1906, the physical geography class of the Pensacola High School, in three sections.

Santa Fe, N. Mex., May 1, 1906, the eight grade pupils of the Allison Mission School.

Springfield, Mo., May 24, 1906, the physical geography class of the Springfield Normal School.

Syracuse, N. Y., May 4, 1906, a class from the Warners, N. Y., High School.

EDUCATIONAL NOTES.

We are informed that the question of offering meteorology as a course of instruction to the students of the University of Arkansas will be taken up as soon as the legislature makes the necessary appropriations, as the university authorities are satisfied that the study of meteorology and climatology will prove of practical benefit.

For admission to Harvard College as a candidate for the degree of S. B., under the new system which goes into effect this year, (as for some years hitherto for admission to the college as a candidate for the degree of A. B., or to the Lawrence Scientific School) a candidate may offer meteorology as one of the elective advanced studies. The student must have pursued a course of observational study, and must take both a written and a laboratory examination; the latter may include the use of instruments, the discussion of observations, and the construction and interpretation of weather maps and climatic charts. A knowledge of elementary physics is required for taking this preparatory course in meteorology, and the university has issued a pamphlet entitled "An Outline of Requirements in Meteorology", to serve as a guide in pursuing the study for the examination. The examination, if passed, counts as one point of the total twenty-six points required for entrance into Harvard College or the Scientific School. The work of preparation in this subject is substantially equivalent to that in the elementary course in meteorology (Geology B) offered to students of the university.

The method of teaching meteorology by laboratory experimentation, by personal drawings, observations, and computations, as distinguished from the mere committing to memory the statements of a text-book, is well illustrated by pages 10–25 of a little pamphlet entitled "Topics in Elementary Geography," by C. P. Sinnot, of the State Normal School, Bridgewater, Mass. This consists of questions or problems

that can be answered merely by reference to the ordinary text-books, or by personal experiments. The student is supposed to have some simple apparatus by means of which the necessary experiments can be made. The pamphlet is very suggestive, and something like it, on a larger scale, would be welcome to many teachers, although nothing can quite take the place of a teacher's personal ingenuity and ability.

RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

H. H. KIMBALL, Librarian.

The following titles have been selected from among the books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be loaned for a limited time to officials and employees who make application for them.

Bombicci, Luigi.
Di talune recenti idee sulla formazione della grandine e della pretesa potenza dei vorticelli degli spari grandinifughi. 44 pp. f°. Bologna. 1901.

Borea, Eligio.
Gli spari contro la grandine. 36 pp. 8°. Pavia. 1899.

Commission Royale pour la Mesure d'un Arc de Méridien au Spitzberg.
Missions scientifiques pour la mesure d'un arc de méridien au Spitzberg entreprises en 1899–1902 sous les auspices des gouvernements suédois et russe. Mission suédoise. Tome II. VIII section. Météorologie. v. p. f°. Stockholm. 1903–1906.

Egypt. Survey Department.
Meteorological report for the year 1903. 211 pp. 12°. Cairo. 1905.

Ginestous, G.
Étude sur le climat de la Tunisie. (Extrait du Bulletin de la Direction de l'Agriculture et du Commerce.) 177 pp. 8°. Tunis. 1903.

Hadley Climatological Laboratory.
Evaporation from water surfaces from Albuquerque, N. M. (Bulletin, vol. 3, No. 10.) 14 pp. 8°. Albuquerque, N. M. 1905.

Hamburg. Deutsche Seewarte.
Jahresbericht über die Tätigkeit . . . iv, 51 pp. 4. Hamburg. 1906.

Hongkong Observatory.
Meteorological observations, 1905. (17), 108 pp. f°. Hongkong. 1906.

Krakau. Observatorium.
Materyaly zebrane przez Sekcye meteorologiczna w roku 1904. 73 pp. 8°. n. p. n. d.

Kremsmünster. Sternwarte.
Resultate . . . 1904 . . . meteorologischen Beobachtungen. 28 pp. 8°. Wels. 1905.

Lausanne. Institut Agricole. Station Météorologique du Champ-de-l'Air.
Observations météorologiques. 1905. ix, 42 pp. 4°. Lausanne. 1906.

Modena. Università. Osservatorio Geofisico.
Osservazioni meteorologiche 1901–1902. 113 pp. f°. Modena. 1906.

Montessus de Ballore, F[ernand].
Les tremblements de terre. Géographie séismologique. v, 475 pp. 8°. Paris. 1906.

Netherlands. Koninklijk Nederlandsch Meteorologisch Institut.
Jaarboek. 1904. xxxiv, 244 pp. f°. Utrecht. 196.
Mededeelingen en Verhandelingen. 1–4. v. p. 8°. Utrecht. 1906.

Riggenbach, A[lbert].
Die bei Regenmessungen wünschbare und erreichbare Genauigkeit. (S. A.–Verh. Natf. Ges., Basel. Teil VIII, Heft 3, 1888.) Pp. 579–590. 8°.

Royal Society of New South Wales.
Journal and Proceedings, 1904. v. p. 8°. Sydney. 1904.

Shaw, W[illiam] N[apier] and Lempfert, R. G. K.
The life history of surface air currents. A study of the surface trajectories of moving air. (Great Britain M. O. 174.) 107 pp. f°. London. 1906.

Sonnblick-Verein.
Jahresbericht . . . 1905. 50 pp. 4°. Wien. 1906.

Stewart, Charles M.
The meteorology of South Africa. 42 pp. 8°. n. p. [1905.]

Stonyhurst College Observatory.
Results of meteorological and magnetical observations . . . 1905. vi, 55 pp. 12°. Clitheroe. 1906.

Thevenet, A.
Essai de climatologie algérienne. 118 pp. f°. Alger-Mustapha. 1896

Wiesner, J[ulius].
Beiträge zur Kenntnis des photochemischen Klimas des Yellowstone-Gebietes . . . 14 pp. f°. Wien. 1906.

Württemberg. Königliches Württembergisches Meteorologisches Zentral-station.
Deutsches meteorologisches Jahrbuch 1903. 58 pp. f°. Stuttgart. 1906.

RECENT PAPERS BEARING ON METEOROLOGY.

H. H. KIMBALL, Librarian.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——

Electrical World and Engineer. New York. Vol. 47. June 2, 1906.
—— Lightning arresters. Pp. 1106–1107.

Journal of the Meteorological Society of Japan. Tokyo. 25th year. Feb., Apr., 1905.
Mukasa, H. Das Temperaturverhältnis von Tsimulpo, Korea. Pp 1–6.
Okada, T. Contributions to the studies of psychrometer covering. Pp. 1–10.

Journal and Proceedings of the Royal Society of New South Wales. Sydney. Vol. 38, 1904.
Jensen, H. I. Possible relations between sun spots and volcanic and seismic phenomena. Pp. 40–90.

Journal of the Scottish Meteorological Society. Edinburgh. 3d series. No. 22.
Halm, J[acob]. On the relations between the diurnal changes of temperature and atmospheric pressure. Pp. 191–214.
—— [Meteorological returns from Hebron.] P. 234.
—— [Meteorological returns from Christmas Island.] P. 234.

Nature. London. Vol. 74. May 10, 1906.
Dines, W. H. Balloons and kites in the service of meteorology.

Proceedings of the Royal Society. London. Series A. Vol. 77. No. 518.
Chree, C. A discussion of atmospheric electrical potential results at Kew, from selected days during the seven years 1898 to 1904. Pp. 385–387.
Dines, W. H. The vertical temperature gradients on the west coast of Scotland and at Oxshott, Surrey. Pp. 440–450.

Quarterly Journal of the Royal Meteorological Society. London. Vol. 32. April, 1906.
Bentley, Richard. The meteorology of daily life. Pp. 81–112.
Mawley, Edward. Report on the phenological observations for 1905. Pp. 113–139.
Dallas, W. L. Brief discussion of the general features of the pressure and wind conditions over the trades-monsoon area. Pp. 141–150.
Newton, William B. The dispersion or prevention of fogs. Pp. 151–155.
Hann, J[ul'us]. The temperature of cyclones and anticyclones. [Translated by R. H Scott.] Pp. 162–168.

Scientific American. New York. Vol. 94. June 16, 1906.
—— European earthquake recorders. P. 498.

Scientific American Supplement. New York. Vol. 61. May 25, 1906.
—— Relative total heat received from sun and sky during any day by horizontal surfaces. P. 25418.

Symons's Meteorological Magazine. London. Vol. 41. May, 1906.
—— The green flash in fiction. Pp. 68–70.

Archives des Sciences Physiques et Naturelles. Genève. 4 période. Tome 21.
Dufour, Henri. La conductibilité de l'air dans les locaux habités. Pp. 361–367.

Comptes Rendus de l'Académie des Sciences. Paris. Tome 142. 14 Mai 1906.
Maillet, Edmond. Sur les grandes crues de saison froide dans les bassins de la Seine et de la Loire. Pp. 1111–1113.

Revue Néphologique. Mons. Mai 1906.
Farman, —. Pocky clouds et statoscope. Pp. 34–35.

Annalen der Hydrographie und Maritimen Meteorologie. Berlin. 34 Jahrgang. Heft 5, 1906.
Meinardus, Wilhelm. Periodische Schwankungen der Eistrift bei Island. Pp. 227–239.
B., v. d. Ein Wirbelsturm im Tuamotu- (Paumotu-) Archipel vom 12. bis 14. März 1905. Pp. 243–244.
—— Taifun in der südlichen Formosa-Strasse am 1. und 2. Juli 1905. Pp. 244–246.

Annalen der Physik. Leipzig. 4 Folge. Band 20. Heft 1, 1906.
Schering, Harald. Der Elster-Geitelsche Zerstreuungsapparat und ein Versuch quantitiver absoluter Zerstreuungsmessung. Pp. 174–195.

Beiblätter zu den Annalen der Physik. Leipzig. Band 30. Heft 10, 1906.
H[asenöhr]l, [F.] Zur Theorie des von einer kreisförmigen Licht-

quellen erzeugten Regenbogens. [Abstract of article by J. M. Pernter.] P. 538.

H[asenöhr]l, [F.] Erklärung des fälschlich "weisser Regenbögen" benannten Bouguerschen Halos. [Abstract of article by J. M. Pernter.] Pp. 538–539.

Gaea. Leipzig. 42 Jahrgang. Juni, 1906.

Klein, —. Die Neuordnung des telegraphischen Witterungsdienstes in Deutschland. Pp. 331–339.

—— Benutzung der atmosphärischen Elektrizität. Pp. 375–376.

—— Elektrische Ladung oberirdischer Freileitungen durch Schneeflocken. P. 376.

—— Einfluss des Sonnenlichtes auf die Bevölkerung. Pp 379–380.

Himmel und Erde. Berlin. 18 Jahrgang. Apr., 1906.

Gallenkamp, W. Die Ergebnisse neuerer Regenforschung. Pp. 306–317.

Illustrirte Aeronautische Mitteilungen. Strassburg. 10 Jahrgang. Apr., 1906.

Uljanin, W. Drachenstation am magnetisch-meteorologischen Observatorium der Universität Kasan. Pp 159–163.

14th Jahres-bericht des Sonnblick-Vereines. 1905. Wien.

—— Stanislaus Kostlivy. Pp. 3–6.

Obermayer, A[lbert] von. Das Observatorium Regina Margherita auf dem Monte Rosa, 4560 m. Pp. 6–16.

—— Das Kodaikánal-Observatorium in Südindien. Pp. 16–18.

—— Resultate der meteorologischen Beobachtungen auf dem Sonnblick, in Bucheban, in Mallnitz und auf der Zugspitze. Pp. 33–34.

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Ficker, Heinz von. Der Föhn vom 4. bis 6. November 1905 in den Ostalpen. Pp. 193–200.

Grossman, [Louis Adolph]. Die horizontale Komponente der ablenkenden Kraft der Erdrotation. Pp. 200–209.

Friesenhof, Gregor. Die Luftdruckgebilde der unteren und der oberen Atmosphäre und ihr Zusammenhang. Pp. 209–214.

Hann, J[ulius]. Klima von Port au Prince, Haiti. Pp. 220–222.

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A DESTRUCTIVE LOCAL STORM NEAR PARIS, ILL.

By Dr. E. O. LAUGHLIN. Dated Paris, Ill., June 2, 1906.

About 10 p. m., Wednesday, May 30, there occurred in this locality a notable storm, which, while evincing much of the destructiveness within a small area and many of the freaks of a tornado, yet seems to have lacked the twisting motion.

The morning of the 30th was ushered in by a gentle shower. At 7 a. m. the temperature was 52° F., the barometer reading 29.95 and the wind direction southeast. During the day the temperature increased to a maximum of 84° F. and the wind became almost a gale, while the barometer remained stationary. Light showers occurred at intervals.

At 6 p. m. a violent thunderstorm came up from the northwest, with some wind and much lightning. The clouds were quite threatening, flying in different directions, tumbling and intermingling in a way suggestive of the tornado. No damage was done by this storm, however, and by 8 o'clock the sky was again serene, except for a cloud bank in the northwest, from which came constant flashes of lightning.

At 10 p. m. another electric storm broke, accompanied by vivid lightning and some wind and hail, but doing no great amount of damage here in the city. Six miles southwest of here this storm developed a destructive intensity. A modern, strongly built schoolhouse was completely demolished and its foundation swept clean. Immediately southwest of this schoolhouse was a grove of some twenty acres; most of the trees in this grove were blown down, many of them being second-growth hickories, eight or ten inches in diameter. Half a mile east of the schoolhouse a large residence was badly wrecked, a smokehouse some twelve feet square having been hurled bodily against it, crushing in one entire side. This house was also struck twice by lightning during the storm, yet none of its inmates were injured.

A dozen other houses in the path of the storm were more or less damaged, some being only unroofed, while others were moved off their foundations or destroyed.

The storm came from the northwest, and a careful survey of the area of destruction, which comprises a path one-half mile wide and some two miles long, shows no evidence of any whirling or twisting force. An old abandoned school building, 60 feet west of the wrecked schoolhouse, was very slightly injured. A coal shed just north of the schoolhouse was moved some ten feet, but not damaged. This coal shed is interesting as showing the terrific force of the hail which accompanied the storm. Every square inch of the surface of its west wall, composed of hard pine, has been battered and indented, frequently to the depth of a quarter of an inch; the shingle roof also shows these imprints.

This storm seems unusual for its concentrated destructiveness without any whirling action, and for the fact that it came from the northwest and that the barometric pressure during its passage was not low. As no weather map was issued for Decoration Day, I do not know the general conditions. The chart for the following day[1] shows a low central at Duluth, Minn., with a pressure of 29.75 inches and a trough-like depression extending into Texas.

THE KODAIKÁNAL SOLAR PHYSICS OBSERVATORY.

By HERBERT H. KIMBALL, Librarian, Weather Bureau.

The establishment of this observatory marks another step forward in the persistent efforts of the government of India to find the relation that is supposed to exist between solar processes and meteorological conditions on the earth.

As early as 1881, Mr. Blanford, then Meteorological Reporter to the government of India, recommended "the improvement of the work of solar observations in order to obtain accurate measures of the sun's heating power at the earth's surface and its periodic variations".[1]

[1] The weather map for the day following, showing conditions at 7 a. m., central standard time, only about nine hours after the storm occurred, probably presents more nearly the conditions at the hour when the storm came than the map of the day itself would do—EDITOR.

[1] Report on the Administration of the Meteorological Department of the government of India in 1900–1901, p. 19.

At that time solar physics investigations were being conducted by two independent branches of the government. The work of photographing the solar disk was carried on under the direction of the Surveyor General, at Dehra, while the Meteorological Department undertook actinometric work, measurements with solar radiation thermometers, and observations of the temperature of the ground.

Observations with a Balfour Stewart actinometer were commenced at the Alipur Observatory, near Calcutta, in November, 1879, at the suggestion of the commission which was appointed to inquire into the disastrous Madras famine of 1876–77. The character of the results obtained indicated that the skies at Alipur were not favorable for solar radiation measurements. An actinometer of the same pattern was therefore sent in 1881 to Mussooree on the summit of one of the foothills of the Himalaya Mountains at an elevation of about 6700 feet.

The observations at this latter station not proving satisfactory, owing, it was assumed, to the almost constant presence of haze in the atmosphere, it was determined to transfer the actinometer to Leh, in the heart of the Himalaya Mountain region, at an elevation of about 11,500 feet. Observations were commenced at this point in November, 1883, but the state of the sky was so disappointing that they were discontinued in October, 1885. During twenty-three months of observing but 60 complete daily series, consisting of double determinations of the radiation at noon, two hours before noon, and two hours after noon, were obtained. On seven days, however, the observations extended over a much longer time than the four hours embraced in a regular daily series.

Upon the return of the instruments and observers from Leh, actinometer observations were resumed at Mussooree. They were so unsatisfactory, however, owing to the frequency of clouds during the wet season and haze during the dry season, that in March, 1889, the actinometer was transferred to Simla, also in the Himalaya foothills, at an elevation of about 7200 feet. Here observations were maintained up to 1898, but on account of adverse meteorological conditions not much value was attached to them, and but few observations were made after November, 1895.

All observations made previous to this date were forwarded for discussion to the Solar Physics Committee of the British Association for the Advancement of Science, but a report upon them has not yet been published.

Meanwhile the government of India had decided to erect a new solar physics observatory at Kodaikánal, on a small plateau in the Palani Hills, in southern India, and to bring together there, under the direction of the Meteorological Department, the various branches of solar physics investigation heretofore carried on under the direction of different departments of the government. The transfer took effect on April 1, 1899, and C. Michie Smith was appointed director of the observatory.

The coordinates of the observatory are approximately as follows:

Latitude, 10° 14′ N.; longitude, 77° 30′ E.; elevation, 7688 feet.

The climate seems to be well adapted to most solar physics work, since we learn from the report of the director that in 1904 there were only 22 days on which observations of some kind could not be made on the sun. From the same source we learn, however, that there are few days when the sky is sufficiently free from haze to permit of actinometric work. The Nilgiris Mountains, distant about eighty miles, are visible about half the time.

From the standpoint of comfort the climate seems to be all that could be desired, since the extremes of temperature for the years 1899–1905 are 77° F. for the maximum and 39° F. for the minimum. The relative humidity is very low, frequently falling below 10 per cent.

The greatest daily wind movement recorded is 991 miles, and special precautions are necessary to prevent vibrations of the instruments from wind effects.

The average number of days with rain during the year is 118, early afternoon showers being frequent at certain seasons of the year. The average annual rainfall is about 60 inches.

The observatory grounds embrace about 100 acres, mostly bare rock, or grass covered ground. To reduce as far as possible the convectional currents arising from this character of surface, many thousands of young trees have been raised for planting about the grounds, mostly from the seed of pines indigenous to the hills in southern California.

Fig. 1 is a reproduction of a photograph of the observatory, recently received.

The principal buildings are as follows: Main observatory; spectroheliograph building; photoheliograph house; transit house; magnetic observatory; cottages for director, assistants, and employees. Other buildings are in process of construction.

The equipment is as follows:[2]

Six-inch Cooke equatorial.

Six-inch Lerebour and Secretan equatorial, remounted by Grubb with a 5-inch Grubb portrait lens of 36 inches focus attached.

Spectrograph, consisting of an 11-inch polar siderostat, 6-inch Grubb lens of 40 feet focus, and a 4-inch concave grating of 10 feet focus, mounted on Rowland's plan. A plane grating with collimator and camera lenses of 8 feet focus can be substituted for the concave grating.

A rhomb, with ends cut at 45°, mounted on a graduated circle, can be placed in front of the slit so as to enable any part of the limb to be brought on to the slit.

Six-inch transit instrument and barrel chronograph, formerly the property of the Great Trigonometrical Survey of India.

Six-prism table spectroscope, Hilger.

Photoheliograph, Dallmeyer No. 4.

Theodolite, 6-inch, Cooke.

Two phototheodolites by Steinheil for cloud photography.

Sextant.

Spectroheliograph with 18-inch siderostat and 12-inch Cooke triple achromatic lens of 20 feet focus, by the Cambridge Scientific Instrument Company, limited.

Evershed spectroscope with three prisms for prominence and sun-spot work, Hilger.

Mean time clock, Kullberg 6326.

Sidereal clock, Shelton.

Mean time chronometer, Kullberg 6299.

Sidereal chronometer, Kullberg 6134.

Tape chronograph, Fuess.

Micrometer for measuring spectrum photographs, Hilger.

Dividing engine, Cambridge Scientific Instrument Company, limited.

Two Balfour Stewart actinometers.

Buchanan's solar calorimeter.

Induction coil with necessary adjuncts.

Small polar siderostat.

Universal instrument.

Complete set of meteorological instruments, including Richard barograph and thermograph, and wind recorders.

The following program of observations, laid down by the Observatories Committee of the Royal Society, has been adopted:[3]

[2] Annual Report of the Director, Kodaikánal and Madras Observatories, 1905, pp. 2, 3.

[3] Annual Report of the Director, Kodaikánal and Madras Observatories, 1903, p. 3.

FIG. 1.—The Solar Physics Observatory, Kodaikánal, India, 1905.

Solar physics—

(a) Observations of the six most widened lines in sun-spot spectra between *F* and *b*, and other six between *b* and *D*.

(b) Observations of the other widened lines in sun-spot spectra.

(c) Visual observations of prominences and chromosphere.

(d) Photographs of solar disk in monochromatic light.

(e) Photographs of sun-spot spectra.

Meteorological observations—

(f) Complete.

Other observations—

(g) Actinometry.

(h) Earthquake records.

(i) Cloud observations.

Magnetic observations—

It will be noticed that the above program does not include magnetic observations, and the list of instruments does not include the equipment of the magnetic observatory. From the Annual Report of the Director for 1904 we learn, however, that the following complete records are taken:

(a) Visually with the magnetometer and dip circle.

(b) By continuous photographic registration with a Watson magnetograph recording horizontal intensity and declination.

A base station is maintained at Periyakulam, three and one-half miles from the foot of the hills, or ten miles from Kodaikánal, at an elevation of about 935 feet, where a complete set of meteorological records is obtained.

The following publications of the observatory have been received at the Weather Bureau Library:

Annual Reports of the Director, Kodaikánal and Madras observatories, 1899–1905.

Kodaikánal Observatory, Bulletin No. I. Widened lines of sun-spot spectra.

The publication of the following bulletins has been announced:

No. II, containing a list of prominences observed between September 1, 1903, and December 31, 1904.

No. III, giving an account of the observations of D_3 as a dark line in the solar spectrum.

No. IV, which brings the record of sun-spot spectra up to the end of June, 1905.

Since January, 1903, the Indian Monthly Weather Review has contained in each issue a report from the Kodaikánal Observatory on the solar and magnetic disturbances of the month. In this report, as in the bulletins, special attention is paid to sun spots and prominences.

Important results are to be expected from an observatory organized on such broad lines. Its connection with the Meteorological Department of the government of India is but additional evidence of the broader field that is to be covered by the science of meteorology in the future. It is to be hoped that the rather discouraging experiences with the Balfour Stewart actinometer will not entirely prevent systematic measurements of solar radiation at the Kodaikánal Observatory, since other apparatus can undoubtedly be found.

HAWAIIAN MOUNTAIN RECORDS.

A letter from Prof. Dr. Julius Hann, dated December 2, 1905, calls attention to the fact that meteorology greatly needs observations from very high stations in the Hawaiian Islands.

You now have a station on Hawaii. This should give an opportunity for the determination of the circulation of the atmosphere at latitude 19° north, in about the middle of the ocean, that would be of the highest value. You can also observe the upper currents of air regularly, instead of occasionally, as is done in scientific expeditions like that of Hergesell and the Prince of Monaco. The existing observations made on Mauna Loa and Mauna Keua, at altitudes of about 4000 meters, give the same result as those made on the peak of Teneriffe, and can not be greatly influenced by local irregularities, as those obtained by Hergesell were influenced by the African Continent. I know that a long series of obser-

vations was made on the summit of Hawaii by the American geodesists. Can not these be published? They would be of the greatest interest. I think that I have read that on Mauna Loa, or possibly Mauna Keua, a long series of meteorological observations was made, but I can not find where the results were published. It would be of the greatest importance to our knowledge of the return upper trades, that Hergesell and Rotch could not find over the Atlantic Ocean, if the observations at great heights in Hawaii had been published. As Preston made gravity determinations at 3980 meters surely there must have been meteorological observations. A permanent station on Mauna Keua would certainly be a desideratum in meteorology.

It is greatly to be hoped that our Hawaiian observers will see what can be done toward discovering and publishing all the observations that have been made at great altitudes in Hawaii. The variations of rainfall, relative humidity, wind velocity, and cloudiness with altitude especially demand observation and study.—*C. A.*

THE PHOTOELECTRIC PROPERTIES OF SELENIUM CELLS.

By Prof. K. E. GUTHE, The State University of Iowa, Iowa City, Iowa. Dated May 14, 1906.

The recent application of the photoelectric properties of a selenium cell during the eclipse on August 30, 1905,[1] has again directed the attention of scientists to the selenium cell as a possible means for measuring intensity of illumination or its use for meteorological observations.

(1) The strongest objection to the use of any instrument for measuring light intensity lies in the fact that the latter is not a physical quantity in the strict sense of the word, but a subjective phenomenon, for which we have been unable so far to find any adequate unit of measurement. In all problems of this kind it should be well understood that usually we estimate luminosity by the subjective effect of light upon our eye, and it is apparent that the estimation of its intensity depends to a considerable extent upon the sensitivity of our eye to the various wave lengths and upon the distribution of the energy of radiation in the spectrum; at the same time, the impression made depends greatly upon the fatigue of the eye and upon afterimages. In fact, the measurement of intensity of lights of different colors, or even different shades, is, from a physicist's point of view, a still unsolved problem. The only satisfactory method of determining the sensitivity of the eye consists in the comparison of the so-called threshold values, i. e., the energy of light of different wave lengths which will just be perceived as light by a well-rested eye. While these comparisons are usually made for the different rays of a given spectrum, it is clear that the relative distribution of energy in the spectrum must be taken into account in order to remove all uncertainty in the results, since different light sources show entirely different relative energy intensities of their components.

In the accompanying fig. 1 I have drawn the threshold values, as given by Ebert,[2] for the different colors of the spectrum, the energy of radiation being the same for all colors. It is claimed, however, that the form of the curve will vary with the intensity of the light. (Purkinje's phenomenon.[3])

Assuming for the sake of argument that the relative sensitivity of the eye for different colors remains unaltered by the degree of luminosity, the first condition to be fulfilled by an instrument intended as a substitute for the eye is that its relative sensitivity for different colors must be the same as for the eye. Pfund[4] has given us constant energy curves for the sensitiveness of selenium cells as a function of the wave length, i. e., curves showing the ratio of the change of electric conductivity to the original under the influence of the various spectral colors. I have reproduced one of them in fig. 1, taking (as in the first curve or that for the eye) the maximum sensitiveness as unity. A comparison between the two curves shows that the selenium cell is much more affected by red rays than by any other, while the eye is most sensitive to green. A reddish light will therefore appear much brighter to the selenium than to the eye, and a direct comparison of lights of different colors will always give unsatisfactory results if made by means of the selenium cells.[5]

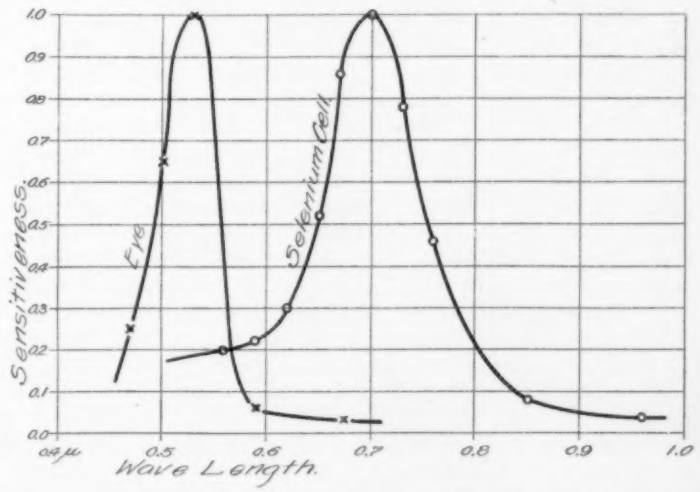

FIG. 1.—Sensitiveness of eye and selenium cell to light of different wave lengths.

The same objection can, however, be made to any other instrument for measuring intensity of illumination, for example, to the one used by Elster, Geitel, and Harms,[6] in which the results are obtained from the loss in quantity of electricity by a negatively charged metal plate when illuminated. In this case only wave lengths between 0.32μ and 0.50μ were used.

(2) Let us suppose that we select arbitrarily the selenium cell as the standard instrument for measuring luminosity; still other conditions must be fulfilled if the apparatus is to prove of value for our purpose. The relation between the intensity of light and the physical quantity from which we calculate the former must not be too complicated. Several attempts have been made to express the relative increase of conductivity as a function of the intensity of illumination. Hesehus[7] gives the following equation:

$$I = a(b^m - 1),$$

where I is the intensity, m the relative change of conductivity, a and b constants, which differ for different cells and even for the same cell vary considerably if the intensity is very strong. There is a great difference in the behavior of different types. The "hard" cells show great sensitiveness to variations in light if the latter is intense and much less for relatively weak illumination, while the "soft" cells show just the opposite. Thus, Ruhmer[8] found that the resistance of a hard cell fell with a change of luminosity from 0 to 4.6 lux 25 per cent and with a change from 22 to 20,000 lux 42 per cent, while the corresponding values for a soft cell were 56 and 25 per cent, respectively.

Every cell must, therefore, be calibrated empirically before any measurements can be made with it. It may be that the new method of preparing cells with pure selenium by using carbon instead of metal electrodes will lead to more constant results in this respect. Recent investigations[9] with such cells

[1] Wulf and Lucas, Phys. Zeitschr., 6, 838, 1905; Astroph. Journ., 23, 153, 1906.
[2] Ebert, Wied. Ann., 33, 150, 1888.
[3] Wundt, Physiologische Psychologie, 5th ed., II, 174.
[4] Pfund, Phil. Mag., 7, 26, 1904.
[5] Wulf and Lucas, l. c.
[6] Elster, Geitel, and Harms, Terrestr. Magnet., 11, 31, 1906.
[7] Hesehus, Phys. Zeitschr. 7, 163, 1906.
[8] Ruhmer, Phys. Zeitschr. 3, 470, 1902.
[9] Pfund, l. c.; Berndt, Phys. Zeitschr. 5, 121, 1904; Coste, C. R., 149, 715, 1905.

have led to the conclusion that Bidwell's theory as to the important rôle of the selenides is unsatisfactory, and that the conductivity depends almost wholly upon the metallic selenium formed throughout the amorphous modification when heated to a temperature of about 200° C. Hesehus has developed an interesting theory of the "allotropic dissociation of selenium," which, on the whole, explains satisfactorily the behavior of the cells.

(3) The constants of the cell must change only little in time, with temperature and atmospheric conditions; but, in this respect also, the selenium cell is by no means perfect. A sensitive cell has a granular structure with numerous minute pores and interstices between the granules, doubtless due to the fact that with the transformation of the amorphous modification to the metallic, which latter has a considerably larger density, irregular contraction will occur and cracks be formed. Expansion caused by an increase of temperature will be followed by a closer electrical contact between the granules and a lowering of resistance. In some cases this temperature effect is very large and it differs in cells of different construction.[10] Carpini[11] found that on heating a cell through 80° or 90° C. the resistance dropped to almost one-tenth of its original value, an enormous change which may, however, in part be due to some transformation into the conducting modification.

Increase of external pressure will also decrease the resistance, as Brown[12] has shown.

Moisture absorbed by the pores doubtless influences the electrical conductivity and thus necessitates the use of a vacuum chamber for the cell.

If I add to this that in course of time the sensitiveness changes, that the contact between the selenium and the electrodes often loosens, and that there is a very annoying after effect, i. e., that the action of the cell is quite sluggish, especially in its return to the original high resistance after the light is shut off, it is apparent that we have not as yet a cell which can be used with any degree of satisfaction for the measurement of intensity of illumination.[13]

Of course it is a different matter if we wish to determine a definite instant at which a sudden change of illumination takes place, as Wulf and Lucas have done in their investigation in connection with the eclipse. It seems that they were able to determine accurately the exact time of first apparent contact of the sun's and moon's disks as well as the end of totality; but only the most sanguine admirer of the selenium cell would dare to draw any conclusion as to the actual change of intensity from the curve given by these investigators, even if we suppose that all spectral colors from the sun are diminished in the same ratio as the eclipse progresses.[14]

WEST INDIAN CHART.

Among the changes in the WEATHER REVIEW for 1906 many will note the absence of the chart of isobars and isotherms for the West Indies. This chart has been kept up in the hope that its usefulness might lead to some system of cooperation among the isolated West Indian services and stations, and eventually to the publication of more complete and satisfactory meteorological and climatological data. Such a union of effort has not yet been attained, but may be realized hereafter, and meanwhile we shall hope to publish occasional references to current sources of information.

The weather of tropical regions is popularly supposed to be very uniform from day to day and year to year, but for this very reason a slight change in temperature or moisture, sunshine or rainfall, has a disproportionately large influence on plants and animals. The large changes that we experience in temperate zones would be disastrous in the Tropics. The regular publication of continuous meteorological details, as well as the different charts for the West Indies, is as important to the student as are the similar publications for the United States. In fact, however, their value to biological studies is not the most important argument for the publication of such monthly charts. The changes in location of the general or tropical areas of high and low pressure, wind, and rain that produce variations in West Indian weather are undoubtedly due to great changes in the general atmospheric conditions over the whole globe. Storms form as the result of these conditions, and we need a daily chart of the West Indies and adjacent regions, with weekly and monthly synoptical charts, such as Hildebrandsson has published, showing the departures from normal, in order to realize the intimate relation between the equatorial and the polar oscillations.—*C. A.*

[10] Aiki and Tanakadate, Math. and Phys. Soc., Tokyo, 16, 217, 1904.
[11] Carpini, Lincei Rend. 14, 667, 1905.
[12] Brown, Phys. Rev. 20, 185, 1905.
[13] See also Dorsey, Monthly Weather Review, 27, 99, 1899, and Berthier, L'Ecl. electr., 38, 441, 1904.
[14] Schwarzschild and Villinger, Phys. Zeitschr., 6, 737, 1905.

PHENOLOGICAL STUDY.

E. N. Transeau, Professor of Biology, Alma College, Michigan, in acknowledging the receipt of a copy of Bulletin 36, says:

> Regarding phenological data I believe the Weather Bureau could secure sufficient data to publish a really valuable map and discussion of this interesting phase of plant geography. The data would have to be secured largely from amateur collectors, for so far as I know very little has been published along this line in this country. Data might also be obtained from herbarium specimens in the larger collections.

Phenology—considered as the study of the development of plants from one epoch to another throughout life—does not belong to meteorology, but to biology, and indeed requires the services of a skilled botanist. If this study should be well organized, under the proper division and bureau of the Department of Agriculture, then many Weather Bureau observers would doubtless be pleased to cooperate, but we can not take the initiative in this matter.—*C. A.*

BACK NUMBERS OF THE WEATHER REVIEW.

The editor will be glad to hear promptly from anyone who desires to complete his set of the MONTHLY WEATHER REVIEW, as it is possible that the accumulation of back numbers may now enable us to complete such sets.—*C. A.*

RESTRICTIONS ON PUBLICATIONS AND THEIR DISTRIBUTION.

In connection with the publication of the MONTHLY WEATHER REVIEW it is proper to remind our correspondents and recipients of the General Order (No. 96, April 14, 1906) recently issued by the Secretary of Agriculture:

> In view of the restrictions placed on the funds available for printing and binding for this Department, and in view of the constantly increasing demands upon these funds, it becomes necessary to adopt restrictive measures in regard to the issue of publications. It is quite as incumbent upon the Department to publish the information it has acquired as to conduct the laboratory work and field and other investigations by which this information is obtained. The only limit placed upon the acquisition or diffusion of this information is that it shall be of value to agriculture.[1] Four ways only seem available by which the expense of the printing and binding for this Department may be judiciously restricted:
>
> First, by prevention of the waste inevitably accompanying a general gratuitous distribution.
>
> Secondly, by careful editing (in the manuscript) of every document submitted for publication, with a view to presenting the facts in the briefest, most succinct style compatible with clearness.
>
> Thirdly, by rigid suppression of the tendency to reedit in the proof, and,

[1] Undoubtedly this is to be interpreted as including all the work of the Department of Agriculture.—EDITOR.

Fourthly, by restriction of illustrations to such as are absolutely necessary.

General orders have already been issued enforcing the second, third, and fourth conditions, and it is only necessary here to reiterate them with added emphasis.

To carry out the first condition it is ordered that hereafter the first edition of every publication shall be limited to such number as is necessary to supply libraries, educational institutions, the press, State, and foreign officials connected with agriculture, exchanges, and such persons as are rendering tangible service to the Department, either by active cooperation in its work or as special correspondents; and, in addition, a small number, to be reserved for emergencies and for use in correspondence, and to furnish a small supply to be placed in the hands of the Superintendent of Documents for sale. Hereafter all reprints shall be confined to such numbers as may be necessary to replenish the supply of the Superintendent of Documents, where the demand for the same, at a price fixed by the Public Printer, continues.

Chiefs of bureaus, offices, and divisions maintaining free mailing lists will cause the same to be rigidly revised in accordance with the distribution indicated above.

This order does not apply to Farmers' Bulletins or to emergency circulars.

METEOROLOGICAL WORK IN CHINA.

By C. FITZHUGH TALMAN, U. S. Weather Bureau.

The Central Meteorological Observatory, at Tokyo, has just issued a series of publications presenting the results of meteorological observations, by Japanese observers, at the following points in the Chinese Empire for the periods indicated:

Chi-fu, latitude 37° 34′ N., longitude 121° 30′ E., October 1–December 31, 1904.

Hang-chau, latitude 30° 11′ N., longitude 120° 12′ E., October 6, 1904–December 31, 1905.

Han-kau, latitude 30° 35′ N., longitude 114° 17′ E., January 17–December 31, 1905.

Mukden, latitude 41° 48′ N., longitude 123° 23′ E., May 1–December 31, 1905.

Nanking, latitude 32° 5′ N., longitude 118° 49′ E., October 12, 1904–December 31, 1905.

Ryojun (Port Arthur), latitude 38′ 47′ N., longitude 121° 16′ E., July 17–December 31, 1905.

Sha-shi. latitude 30° 18′ N., longitude 112° 15′ E., January 18–December 31, 1905.

Tairen (Dalny), latitude 38° 56′ N., longitude 121° 36′ E., September 7, 1904–December 31, 1905.

Tientsin, latitude 39° 10′ N., longitude 117° 10′ E., September 19, 1904–December 31, 1905.

Yinkow, latitude 40° 40′ N., longitude 122° 14′ E., October 1, 1904–December 31, 1905.

An additional pamphlet contains results from the new Japanese station at Kushunkotan (Korsakovsk), in the island of Sakhalin, for the period from October 10 to December 31, 1905. The date of the opening of this station denotes the eagerness of the Japanese to extend their meteorological net work; for it will be remembered that the treaty by virtue of which southern Sakhalin ceased to be forbidden ground to Japanese enterprise was only signed September 5, 1905. It is also worthy of note that observations at Mukden began less than two months after the occupation of that city by the Japanese army, while the station at Tairen appears to have been operated for about four months within hearing, if not within range, of the enemy's guns at Port Arthur.

The tabulated results for the stations and periods given above fill about two hundred quarto pages, and are uniform in character with those of the second order stations in Japan as published in the Monthly Report of the Central Meteorological Observatory.

Meteorological observations on so ambitious a scale have not previously been undertaken in China, except at the well-known observatories of Hongkong and Zi-ka-wei, the former Russian observatory at Peking, and, latterly, at the German seaport of Tsingtao. The only other observations approaching them in fullness are those recently executed by British observers at Wei-hai-wei.

Of the new Japanese stations four are located at points for which meteorological data appear to have been heretofore entirely lacking; these are Sha-shi, Nanking, Hang-chau, and Tairen.

A fringe of meteorological stations now extends along the China coast, and eight stations exist in the Yang-tze valley above Shanghai. The greater part of these stations are connected with the custom-houses and light-houses of the Imperial Chinese Maritime Customs, and report their observations to the Hongkong and Zi-ka-wei observatories. The Japanese will undoubtedly extend their meteorological service in Manchuria, and are said to be contemplating the establishment of a large meteorological and magnetic observatory at Peking. In the extreme south observations are made at the inland treaty ports of Wu-chau and Lung-chau. Meanwhile the "back blocks" of China—the regions away from the coast and the treaty ports—are completely unknown to the meteorologist, who stands sorely in need of more information concerning the climate of the whole interior of the Asiatic Continent.

China is now dotted over with missionary stations; European and American engineers are building railroads, opening mines, and erecting manufactories in many parts of the Empire; and the Chinese Government is importing foreign teachers for several of its schools and colleges. To the meteorologist this means that China's population of possible meteorological observers is rapidly growing.

If we could press into the service of meteorology a tithe of the educated foreigners now resident in China, we should soon be able to fill some of the most regrettable gaps on the climatic charts of the globe, and also to obtain much light upon the problems connected with the winter "high" and the summer "low" of central Asia.

ABNORMAL APRIL TEMPERATURES IN NEW SOUTH WALES.

By H. A. HUNT, Acting Meteorologist. Dated Sydney Observatory, N. S. W., Australia, May 3, 1906.

The month of April, 1906, possessed such abnormal temperature features in New South Wales that a brief note thereon may be of interest to the readers of the MONTHLY WEATHER REVIEW.

Unseasonably warm weather was experienced throughout the month, and during the Easter holidays what might be termed a hot wave passed slowly over our state; its duration was most remarkable for the month of April. The following consecutive readings were recorded at the Sydney Observatory:

April, 1906.	° F.
13	76.8
14	79.0
15	87.2
16	85.0
17	81.2
18	88.0
19	84.6

Taking the mean temperature for the whole of this month at the observatory, we find that all previous records, extending back to the year 1859, have been eclipsed. The mean for the month just ended was 67.7° F., which is 3° in excess of the normal, and 0.5° higher than the previous next highest mean, that is, 67.2° F., which was the mean for April, 1897.

Taking the average of all maximum readings, the abnormal character of the heat becomes still more apparent. The average maximum for the month just ended was 75.8° F., or 4.9° above the normal, and 1.2° higher than the previous next highest average maximum, that is, 74.6° F., in April, 1897.

The following table shows the means for April, 1906, compared with the results for previous years, at Sydney Observatory:

	Mean temperature.	Mean maximum.	Mean minimum.
	° F.	° F.	° F.
April, 1906	67.7	75.8	59.6
Average for previous 47 years	64.7	70.9	58.3
Excess of 1906 over average for previous 47 years	3.0	4.9	1.3

Unseasonably high temperatures for this month have also been experienced in the other Australian states; and we have noticed by the cablegrams published in the Sydney daily papers that a similar heat visitation was experienced in parts of Great Britain about the same time as our heat wave here, above noted.

SEVERE HAILSTORM IN THE GULF OF MEXICO.

By Mr. R. G. BINDLEY.[1]

[Communicated by Mr. JAMES PAGE, Chief of Division of Ocean Meteorology.]

Whilst crossing the Gulf of Mexico, during the night of March 17 and morning of the 18th, in latitude 28° 48′ N., and longitude 93° 47′ W., we experienced a heavy thunderstorm, and during the height of the storm a hail squall of exceeding violence crossed the vessel. At 8 p. m. the wind was east 5;[2] the sky was overcast with strato-cumulus clouds and a slight haze existed; occasionally a flash of sheet lightning was seen. At 9 p. m. the haze grew slightly denser, being able to see only about two miles, and the clouds were broken in places so that we could discern the stars at intervals. This state continued until 11:30 p. m., when we noticed that the electric storm was advancing toward us; the sheet lightning was flashing more frequently, and the distant rumble of thunder could be heard. The sky had again become completely overcast, and heavy showers of rain began to fall.

At midnight the sheet lightning was almost one continuous flash, with only a second's interval between flashes; occasionally the sky was lighted vividly for three or four minutes at a time. At 0:15 a. m. the first flash of forked lightning was observed in the southeast. The storm approached rapidly and struck the ship at about 0:35 to 0:45 a. m., during which time a most severe and dangerous hail squall crossed the vessel. Its approach was heralded by the loud hissing sound, which generally precedes the heavy squalls, caused by the hailstones striking the water.

When the squall struck the ship the stones were about the size of walnuts, but in the center of the squall they were lumps of ice equal in size to large oranges; some picked up afterwards were two and one-half inches in diameter.

During the squall the ship was stopped and the officer of the watch and helmsman were compelled to seek shelter. The first officer sustained a severe bruise, caused by a stone striking the back of his neck, and the helmsman received a scalp wound from the same cause. These stones fell with such force as to dent the binnacles in several places and chip the paint off rails and other painted surfaces. During the night the barometer was steady at 30.03 (corrected of error); the thermometer at 64° F.; the temperature of the sea surface being 64° to 65° F. After the hail heavy rain set in and lasted until 6 a. m., when the weather generally cleared.

THE SEICHE AND ITS MECHANICAL EXPLANATION.

Prof. Dr. H. Ebert, of Munich, gives the following summary of the extensive memoir on the theory of seiches by Professor Chrystal, published in the Transactions of the Royal Society of Edinburgh, during 1905, with a general abstract in the proceedings of the same society.

[1] Mr. Bindley was an officer of the British S. S. *Jamaican*, Captain Robb, bound from Galveston to Liverpool, at the time when this storm was encountered.

[2] That is, the force of the wind was 5 on the Beaufort scale.—EDITOR.

After a condensed review of the development of the study of seiches, and a very complete bibliography of the subject, Professor Chrystal gives a condensed statement of the results of his own research, which includes the description of a beautiful model made for the study of seiche oscillations in a rectangular trough, built for that purpose, near Wedderburn, Scotland. He passes then to the second part of his work, which consists of a general theory, now for the first time completely developed, of small longitudinal seiches in lake basins having variable depths and cross sections. An idea of this mathematical theory may be derived from the following statement. The horizontal velocities and accelerations for any particle of water, as also the vertical movements, are expressed as differential functions of a special auxiliary quantity v. The solution of these equations is expressed as a sine and cosine, or Fourier, series, whose coefficients, P, again depend upon the same auxiliary quantity, v. Thus the problem of the seiche, in its most general form, is reduced to that of a vibrating cord, fastened at both ends, and for which the ratio of the tension to the mass, per unit of length, depends upon the same auxiliary quantity, v. In conclusion Doctor Bruner states that the general results of the computations by Professor Chrystal's formula were compared with the formula of Dubois, which is the only rule according to which we have hitherto been able to compute the periodic time of oscillation of the seiche when we know the dimensions of the lake. The result of the comparison shows that the formula of Dubois gives results too large in lakes with concave sides, and too small in lakes with convex sides, but this purely empirical formula in many cases gives a good first approximation. Through this thorough theoretical investigation by Professor Chrystal the study of seiches will certainly receive abundant stimulus.

C. A.

METEOROLOGY IN GERMAN UNIVERSITIES.

The Physikalische Zeitschrift for April 15, 1906, gives quite a complete list of the courses of scientific lectures in German speaking universities in Europe, for the summer term, 1906, from which we select the following list of lectures that specifically touch upon meteorology or climatology. The figures given after each title indicate the number of lectures per week; these are, of course, additional to the hours of laboratory practise, since these lectures correspond to our post graduate courses for attaining the degree Ph. D.

Aachen (Aix-la-Chapelle) University.—Professor Polis: Climatology 2; special topics in meteorology 1; technical meteorology 1.

Berlin University.—Professor Börnstein: The weather and the prediction of the weather, 1. Professor von Bezold: Statics and dynamics of the atmosphere, 2; practical meteorological work for beginners, 3; same, for advanced students, 2; meteorological conferences, 1. Professor Hellmann: Introduction to meteorology, instrumental, observational, and historical, 2; practical climatology, 1. Professor Less: Introduction to climatology, 1; special weather phenomena, 1.

Berlin Technical High School.—Professor Cassner: Introduction to the theory of highs and lows in meteorology.

Breslau University.—Professor von der Borne: Physics of the atmosphere of the earth, 2; geophysical conferences and exercises, occasional.

Göttingen University.—Professor Wiechert: Terrestrial magnetism, 2; aurora, 1; work in geophysics, 1.

Gratz University.—Professor Benndorff: Theoretical meteorology, 3; practise in physical computations, 2.

Greifswald University.—Professor Holtz: Meteorology, including optical phenomena, 1; physics of the earth with experiments, 1.

Halle University.—Professor Buchholtz: Theory of atmospheric refraction, etc., 3.

Heidelberg University.—Professor Pockels: Introduction to theoretical physics, 3; geophysics, 1. Professor Wolf: Meteorology, 2.

Innsbruck University.—Professor Trabert: Cosmical physics, 2; elements of climatology, 1; meteorological work, 2.

Karlsruhe Technical High School.—Professor Schultheiss: Synoptic meteorology with practise, 1.

Prague University.—Professor Spitaler: Astrophysics, 2; terrestrial magnetism, 2.

Prague Technical High School.—Professor Pichl: Meteorology and climatology, 1; climatological practise, 1.

Strassburg University.—Professor Hergesell: Meteorological conferences, 2; meteorological practise, 2. Professor de Quervain: Climatology, 1.

Stuttgart Technical High School.—Professor von Weyrauch: Aerostatics and aerodynamics, 2.

Vienna University.—Professor Hann: General meteorology, 2; dynamic meteorology, 2; oceanography, 1. Professor Pernter: Meteorological instruments, with practise at the central institute for meteorology and geo-dynamics, 3; meteorological conferences, 1; meteorological work for advanced students, 3. Professor Felix Exner: Insolation and radiation at the earth's surface, 2. Professor Valentin: Magnetic work, 2. Professor Przibram: Radioactivity, 2.

Würtzburg University.—Professor Wien: Electricity and optics, 5.

Beside the above definitively meteorological courses there are a great number of others in hydrodynamics, thermodynamics, optics, electricity, and general physics, which include applications to special atmospheric phenomena.

The expense of attending a course of lectures in a European university is usually not greater than the attendance on American lectures of the same grade. The added facility that one acquires in the use of the German or French language, as well as the stimulus that comes from working together with young men of the same tastes, will doubtless always attract the most ambitious American students. Of course the same arguments bring many foreigners to American universities, and this international scientific intercourse can but be of permanent value to a science that embraces the atmosphere over the whole globe.—*C. A.*

OBSERVATIONS OF "SHADOW BANDS" WITHOUT AN ECLIPSE.

In the Comptes Rendus, Paris, April 9, 1906, M. Cl. Rozet describes an interesting method that he has devised for observing "shadow bands."

Heretofore this interesting and mysterious phenomenon has been observed only during the occurrence of solar eclipses, but by a very simple method M. Rozet has been able to make daily observations of the bands at sunrise and sunset. The light of the sun at the time of its appearance and disappearance behind somewhat lofty mountains on the horizon is received on a white screen, arranged in the observer's room, and bands are produced apparently identical in character with those observed during an eclipse. The following is a summary of the results of M. Rozet's observations:

(1) The position of the dark bands on a screen perpendicular to the sun's rays is invariably parallel to that part of the crest of the mountain at which the sun rises or sets.

(2) The direction of the movement is always perpendicular to the position of the bands, but this movement may take place in two opposite directions, which may be called "direct" and "retrograde." In the direct movement the bands seem to fall, that is, to enter the shadow of the mountain projected on the screen; in retrograde movement to rise, i. e., to emerge from the shadow. They may move in either direction both at sunrise and sunset, and in successive appearances and disappearances of the sun at brief intervals, due to irregularities of the mountain crest, their direction may differ. In the same appearance or disappearance of the sun the bands usually move in a single direction; however, on several occasions, after a few seconds of direct motion, they have been observed to retrograde, and at other times times the screen was traversed at the same time by two distinct series of bands, not exactly parallel, and moving in opposite directions.

(3) The velocity of movement is subject to much variation; it has, however, been observed to have a pretty close relation to the velocity of the wind; the rapid movements are coincident with high winds, while the slowest movements occur when the air is calm or nearly so. The greatest velocities attained are approximately six to eight meters a second, the least one to two meters, and the ordinary velocity two to four meters.

(4) The bands are usually seen as soon as the sun appears. Sometimes they do not appear until two or three seconds after the beginning of sunrise; they also sometimes disappear a few seconds before the end of sunset; in these cases their movement is in the retrograde direction. When the appearance or disappearance of the sun takes place behind a portion of the mountain crest perpendicular to the sun's apparent movement the usual duration of the visibility of the bands is twelve to fifteen seconds. The visible part of the sun need not be very small; in one instance bands were observed when as much as a quarter of the solar surface was visible.

(5) At first faint, broad, and far apart, the bands become more sharply defined, narrower, and closer together up to the time of their complete cessation, whether at sunrise or sunset, despite the fact that the intensity of the light increases in the former case and diminishes in the latter. Sometimes, instead of occurring at uniform distances apart, they move in groups of five or six. Their breadth, which is commonly three to four centimeters, may vary from one to seven centimeters, while the distance apart, which is ordinarily three to four centimeters, may vary from one to twenty centimeters. The width of the bands and their distances apart appear to vary with the velocity; they are greatest when the movement is most rapid.

(6) The color of the bands is, over their entire length, a uniform gray, darker or lighter according as the bands are more or less narrow. Often one of the edges (the second with reference to the direction of movement) seems better defined than the other. The spaces between the bands are illuminated irregularly without relation to the increase or decrease of the solar light.

In the course of the observations the distances of the mountains from the screen and their elevation above the theoretical horizon have varied from 6 kilometers to 36 kilometers, and from 3° to 22°, respectively. Despite these great differences, no variation in the phenomenon has been observed which could be attributed thereto. The variation appears to be related solely to atmospheric conditions.—*C. F. T.*

TORNADO IN AUSTRALIA.

A very destructive local storm passed over North Sydney, N. S. W., on the afternoon of Tuesday, March 27. It had every appearance of being a mild form of the American tornado. During the previous morning the weather had been showery and stormy, and the daily weather map of the 27th shows that Sydney was, at that time, on the east side of a trough of relatively low pressure extending from Melbourne northward. In the Southern Hemisphere the circulation of the winds is such that a depression of this kind in the eastern part of Australia brings to Sydney northeast winds and rain, analogous to the southeast winds with rain that are experienced in the Northern Hemisphere when the center of a low area passes by on the north side of an observer. Our American tornadoes occur in this region of southerly winds, and move eastward; while this North Sydney tornado occurred in the corresponding region of northeast winds, and moved southeastward. The path of the tornado through North Sydney, with many illustrations of the damage done, is published in full in the Sydney Daily Telegraph of March 28. From the text, written by Mr. Andrew Noble, and some contributions by Mr. H. A. Hunt, the Government Meteorologist, we make the following abstract:

A little before 2 p. m. there was a sudden development, and before

the hour had struck many homes were destroyed. The storm was introduced by a very sudden downfall of torrents of rain that was described as like the bursting of a waterspout, or like a cloudburst. * * * The rain lasted for a few minutes followed by a lull, and then, with a bang and a howl, came the wind. * * * The greatest width of the tornado's direct influence was about a hundred and fifty yards. Buildings were razed to the ground, others were unroofed and others collapsed. The wind cut a lane for itself, with very clearly marked edges. A stately palm tree still stands, with all the branches on one side ripped off, but the other side untouched. Sergeant Brennan, of the North Sydney police, watched the wind sweep one side of his house, while on the other side there was no disturbance. * * * Leslie's house was lifted up and carried along bodily, until it was crushed against some large trees. Mr. Wilson, in speaking of Kemsley's cottage, says "that it rose quite steadily, as if something was underneath, raising it up, and then came down almost as gently, like a parachute; then it was moved horizontally about five feet." At Windgrove's cottage a sheet of iron was taken out of the roof, almost straight up in the air, and caught in the limbs of a tree; then the wind destroyed the cottage. Another house was lifted up bodily into the air, like a box kite, and collapsed while in the air. The tornado passed on, across Lavender Bay and over the Botanic Garden.

Mr. Hunt states that this storm should not be called a hurricane or a cyclone, but a tornado, or destructive local whirlwind. Many similar tornadoes are on record in New South Wales, such as that at Pyrmont, in 1890 or 1891; Leichhardt and West Balmain, in 1889; at Wyalong in 1893; at Pirillie in 1895; and at Mudgee and Nevertire in December, 1896; at Narrabri in January, 1902; at Berrigan and Denilquin in 1901; at Bourke in 1894, and at Cootamundra in April, 1903.

C. A.

CHANGE OF TITLE AND ADDRESS.

The Director of the Astro-Meteorological Observatory in Trieste, (Prof. Dr. Edward Mazelle) announces that this institution has been transferred to the Minister of Commerce, and its future title and address will be:

K. k. Maritimes Observatorium, Trieste, Austria.

METEOROLOGICAL INSTITUTE OF SAXONY.

Prof. Dr. Paul Schreiber, Director of the Royal Meteorological Institute, Saxony, whose central office has for many years been located at Chemnitz, announces that the office of the Institute has been transferred from Chemnitz to Dresden. The mail address will be: Dresden, Neustadt, Grosse Meissner Strasse 15, for the official mail; but Professor Schreiber's personal address will be simply Dresden, N. 6.

The Meteorological Institute of Saxony conducts its own daily weather forecasts, and maintains one central station of the first order, fifteen stations of the second order, six of the third order, 150 of the fourth order, 600 stations for the measurement of depth of snow, and 4000 stations for the reports of hail and thunderstorms. It quite recently employed two scientific assistants, four clerks, one mechanic, one lithographer, and twelve computers. The annual allowance is about twelve thousand dollars, which is exclusive of the salary of the director.—*C. A.*

MONTHLY REVIEW OF THE PROGRESS OF CLIMATOLOGY THROUGHOUT THE WORLD.

By C. FITZHUGH TALMAN, U. S. Weather Bureau.

CLIMATOLOGY OF THE NILE VALLEY.

In 1893 Sir W. Willcocks wrote:

As Egypt possesses no barometric, thermometric, or rain-gage stations in the valley of the Nile, we are always ignorant of the coming flood.

In his "Rains of the Nile basin in 1904" (Cairo, 1905), Capt. H. G. Lyons says:

Five years ago there were not more than six or eight places in the Nile basin where the rainfall was being measured regularly, while to-day there are more than forty, of which thirty-two lie to the south of Berber (latitude 18° north). The parts played by the different tributaries of the Nile have also been determined during the last few years so that we are now able to recognize, with very fair accuracy, the share which the rainfall of the different districts takes in supplying the Nile, and to trace the effects of excessive or deficient rainfall in any area.

Captain Lyons does not think it necessary to add that the immense progress recently made in the hydrological investigation of the Nile Valley is largely the fruit of his own efforts. In his "Rains of the Nile basin in 1905,"[1] just issued, we have the latest statistics regarding the distribution of rainfall stations in this region. Sixty-four of these are now in operation, of which 31 are in Egypt and the Sudan, the remainder being situated in the neighboring territories of Eritrea, Uganda, British East Africa, German East Africa, and British Central Africa. Besides these stations where the rainfall is regularly measured there are 44 stations which record the number of rainy days.

While the rainfall has been the chief subject of enquiry in northeastern Africa, the investigation of the other elements of climate has gone forward apace in this region during the past few years, as is fully attested by the wealth of meteorological data cited in Captain Lyons's beautiful monograph on the physiography of the Nile and its basin,[2] just published by the Egyptian Government. Most significant is the progress that is being made in the observation of atmospheric pressure. The leveling operations carried out by the Sudan Irrigation Service during 1905 have enabled the altitudes of the stations south of Khartum to be determined with considerable accuracy, so that it is now possible to reduce to sea level the observations of pressure made at many inland stations. New charts of pressure distribution have been drawn, which show clearly the very pronounced trend of the isobars from north to south along the Nile Valley, instead of in a westerly direction as far as the west coast of Africa, as was assumed when the only observations available were those of coast stations.

It has now been known for some years that the Nile flood is a faithful index of the rainfall of Abyssinia; since the volume of the White Nile is held back by the Blue Nile when in flood and the supply it furnishes is practically negligible during the flood season. The Abyssinian rainfall, in its turn, is a manifestation of the intensity and direction of the east African monsoon current, and therefore of the pressure conditions in this vicinity. The author adduces much evidence to prove that atmospheric pressure in northeastern Africa varies inversely as the rainfall of Abyssinia. A similar relation between pressure and rainfall has been demonstrated in other parts of the globe. Until recently, however, few pressure observations were available within the Nile basin; such outlying stations as Aden, Cairo, Alexandria, and Beirut have been used for purposes of comparison with the Nile flood.[3] In the present work the author is able to present provisional isobars for the summer months, for the whole of northeastern Africa, in the construction of which he has utilized observations from several new stations in the interior; while for the month of July he extends his isobars over the whole of northern Africa, with results differing markedly from all previous charts. A center of low pressure is conjectured to exist at this season between Lake Chad and Timbuctu. It is to be hoped that some of the French and British residents of this region will soon undertake regular observations of pressure, so that we may have positive information as to the existence or nonexistence of such a depression.

CYCLONIC WEATHER TYPES.

The last few years have been fruitful in suggestions looking to an improvement in the methods of presenting the statistics of climate. The demands made upon climatology are many and diverse; and it is probable that the climate of no place or region has ever been so fully portrayed as to satisfy all of

[1] Lyons, H. G. The rains of the Nile basin in 1905. Cairo, 1906.

[2] Lyons, H. G. The physiography of the river Nile and its basin. Cairo, 1906.

[3] Cf. On the relation between variations of atmospheric pressure in northeast Africa and the Nile flood, Proc. Roy. Soc., vol. A76, 1905, pp. 66–86.

them. It is notably true that the ordinary climatic tables often give a very imperfect idea of many of the features of a climate which most impress themselves upon one's mind in the course of actual experience of the climate in question. A recent paper by Prof. R. DeC. Ward, entitled "Suggestions concerning a more rational treatment of climatology,"[4] reenforces the recommendation of others that the cyclonic control of the weather be more fully exhibited in climatological statistics. The following extracts indicate the line of argument pursued in this paper:

> In the past, climatology has been too much concerned with averages and too little concerned with the units, i. e., the individual weather changes which go to make up the average. These changes, being actually experienced from day to day, and affecting man's activities, his crops, his health, his mode of life, are of the greatest interest and importance to him.
>
> Regular diurnal changes are very frequently overshadowed by the larger irregular changes which are due to the passage of cyclones and anticyclones. The essence of the cyclonic control being its irregularity, it is obvious that the cyclonic effects must very largely disappear when the usual time units are taken as the basis for averaging climatic data. Thus, the usual means, the ranges, the extremes, for a day, a month, a year, can not adequately emphasize the irregular cyclonic changes in the different elements, and yet these very changes are of the greatest importance in their effects on man, and really give a climate its character.

In other words, typical weather is as worthy of a place in climatological tables and descriptions as average weather. Professor Ward states that he is now engaged in making up diagrams illustrating weather types for various parts of the United States.

CLIMATE OF CENTRAL ASIA.

The climate of central Asia is still so little known that every scrap of meteorological information from that quarter is welcome. Even the hasty observations of travelers give us a valuable insight into some of the broader climatic features. It will be remembered that the British Mission to Lhasa, in 1903–4, dispelled the illusion that southern Tibet was an inhospitable frozen desert; the historians of the Mission paint alluring pictures of a rich agricultural country, which Colonel Waddell goes so far as to call "one of the most delightful residential places in the world."

Of the scientific results of Dr. Sven Hedin's journey of 1899–1902 to western and central Tibet and the adjacent regions to the north, the first section of the part devoted to meteorology has recently appeared,[5] and contains all the meteorological observations made during this journey, together with those made during Doctor Hedin's journey of 1894–1897. Most of these observations are from regions for which absolutely no meteorological data were previously available. A second section will contain an account of the methods of observation and a general discussion of the results from a climatological point of view. Doctor Hedin expects that this discussion will throw light upon several phenomena connected with the meteorology of the earth's greatest continent, such as the violent and constant east-northeast winds that blow in spring in the Lop-nor region, and that have wrought such marked changes, within historic times, in the configuration of that country.

It is interesting to note that much important meteorological work was carried on by the expedition of the Imperial Russian Geographical Society to Mongolia and Kham, including over a year of observations at a fixed station in Ts'aidam, contemporaneously with part of the work of Doctor Hedin. A preliminary report on the results was given by A. Kaminski in his recent paper on "The climate of Ts'aidam."[6] As Ts'aidam borders on the region explored by Doctor Hedin, it would be a matter of the highest interest to coordinate the observations of the two expeditions, supplemented by the results obtained at the permanent stations in adjoining countries, such as Leh, in Ladak, and Kashgar, in East Turkestan.

STATIONS IN GERMAN EAST AFRICA.

A recent paper by Dr. P. Heidke,[7] besides communicating the results of observations at the climatological stations in German East Africa during the years 1899–1902, furnishes very full particulars regarding the history and topographical conditions of each station, exposure of instruments, methods of observation, etc. It is a pity that this kind of information is not more generally given in connection with the results of observations. The value of much climatological material is impaired by a lack of information regarding the conditions under which it was obtained.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

During the first seven days of May the barometer was low over the British Isles and the western Atlantic and high over the Azores. From the 9th to 16th a barometric depression covered Spain and Portugal, the barometer was high over the British Isles and the western Atlantic, and there was a gradual breaking up of the Azores area of high barometer. From the 18th to 21st the barometric depression that had covered southwestern Europe apparently moved northeastward over France and Germany, the barometer fell rapidly in the vicinity of the Azores, and a disturbance appeared south of the Florida Peninsula. From the 22d until the close of the month the pressure was generally low over the British coasts. Over the Azores the barometer continued low from the 19th to the 28th and reached a reported minimum of 29.50 inches, with a wind velocity of 48 miles an hour, on the 26th, after which the disturbance in that region appeared to move northeastward toward the British coasts. From the 22d to 25th a disturbance moved northward over the Florida Peninsula, and on the 27th and 28th a storm moved eastward off the middle Atlantic coast of the United States.

During the first half of the month, and from the 19th to 29th, the weather was cool in the United States, and heavy frost and temperature near the freezing point occurred in the Middle Atlantic States and the Ohio Valley on the morning of the 11th, and light frost in the upper Mississippi Valley and the Lake region and at points in the interior of the Middle Atlantic States on the 29th. From the 17th to 19th a warm wave swept the middle and northern districts east of the Rocky Mountains, attended by temperatures that rose to and slightly above 90° from the upper Mississippi Valley over the Ohio Valley and Middle Atlantic States on the 17th and 18th.

At the close of the second decade of the month dry weather had prevailed nearly two weeks from the Mississippi River over the Ohio Valley and the Middle and South Atlantic and east Gulf States. During this period precipitation had been in excess from the valley of the Red River of the North to the Pacific coast. During the third decade of the month the drought in the Middle, Eastern, and Southeastern States was broken by copious rains.

There were four well-defined storm periods in the United States. From the 1st to 5th low areas I, II, and V caused

[4] Report of the Eighth International Geographic Congress. Washington, 1905. Pp. 277–293.

[5] Hedin, Sven. Scientific results of a journey in central Asia, 1899–1902. Vol. 5, part 1, a. Meteorologie von Dr. Nils Ekholm. 1. Die Beobachtungen, 1894–1897 und 1899–1902. Stockholm, 1905.

[6] Report of the Eighth International Geographic Congress. Washington, 1905. Pp. 380–385.

[7] Heidke, P. Meteorologische Beobachtungen aus Deutsch-Ostafrika Mitteilungen von Forschungsreisenden und Gelehrten aus den Deutschen Schutzgebieten. Bd. 19, Hft. 1, pp. 40–106.

rain and thunderstorms from the Missouri Valley to the middle Atlantic and New England coasts. From the 7th to 10th low area VI produced precipitation from the Missouri Valley to the north Atlantic coast, and on the 10th snow was reported as far south as the mountains of northern Virginia. Under the influence of low areas VII, VIII, IX, and X rain fell from the Pacific coast to the upper Lakes from the 10th to 19th, and snow was reported during this period in locations from the northern Plateau region to Michigan. From the 22d to 25th low area XIV caused heavy rains in the Southeastern States, and at Jacksonville, Fla., 12.86 inches of rain fell during the seventy-two hours ending at 8 a. m., of the 25th. Low area XV, that appeared over Arizona on the 22d and reached the middle Atlantic coast the night of the 27th, was attended by rain generally east of the Rocky Mountains. During the closing days of the month practically all sections of the country were visited by occasional rains.

Coast and Lake ports were advised regarding storms that threatened to inconvenience or damage shipping.

BOSTON FORECAST DISTRICT.

The chief weather feature of the month was the storm of the 27th to 29th, during which general and heavy rain fell throughout New England; at several points in central and southern New England the rainfall was between four and five inches. Freshets were caused in rivers and streams and in many sections lowlands were flooded. The storm was attended by high winds on the southern New England coast, but no damage to shipping has been reported. Thunderstorms were more frequent than usual and in a number of instances were severe, buildings being struck by lightning and burned and a number of persons injured. Frosts occurred frequently and at a later date than usual. Frost warnings were issued to cranberry growers on the 10th and 29th. During the night of the 10-11th the temperature in the bogs ranged from 25° to 28° and killing frosts occurred. Frosts, less severe, were noted on several other dates.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

The month was abnormally dry over the southern portion of the west Gulf States. No general disturbance occurred and no special warnings were issued.—*I. M. Cline, District Forecaster.*

CHICAGO FORECAST DISTRICT.

No storms of unusual severity occurred in the North-Central States. Warnings were, however, issued in advance of several well-defined storms, and as no casualties were reported it is probable that they were of great service. Frost warnings were issued on several dates and were verified. Special warnings for the cranberry marshes of Wisconsin were also in every case verified, and were important for the reason that the owners were enabled to flood the marshes in anticipation of frost.—*H. J. Cox, Professor and District Forecaster.*

LOUISVILLE FORECAST DISTRICT.

With the exception of cool periods from the 6th to 10th, and on the 20th-21st and 28th the temperature in Kentucky and Tennessee was abnormally high. Frost warnings were issued for Kentucky on the morning of the 6th and for Kentucky and Tennessee on the mornings of the 7th and 9th, all of which were verified. During the first five or six days thunderstorms occurred, after which a period of dry weather continued practically until the 25th. From the 25th until the 28th copious showers fell in both States, and on the 31st thunderstorms, with excessive rains, occurred, and damaging wind squalls visited a large portion of Kentucky.—*F. J. Walz, District Forecaster.*

DENVER FORECAST DISTRICT.

May presented no unusual weather features. Temperature was below the normal, except in eastern Colorado; heavy frost was confined to the high stations, and the damage by frost at lower altitudes was slight. No special warnings were issued or needed. Precipitation was in excess in southwestern Wyoming, western Colorado, Utah, and southern New Mexico, and a corresponding deficiency was noted east of the mountains and in northern portions of New Mexico and Arizona—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.

The noteworthy features of the month were unusually heavy rains during the last week, with surface winds in California from the south and southwest, essentially rain-bearing winds, and rainfall at San Francisco heavier for the season than at any time since 1884.—*A. G. McAdie, Professor and District Forecaster.*

PORTLAND, OREG., FORECAST DISTRICT.

May was unusually stormy. The principal disturbance made its appearance off the Washington coast the morning of the 25th, and storm warnings were immediately ordered at all seaports. The following night a maximum wind velocity of 68 miles occurred at North Head, Wash., and high winds were reported in the Puget Sound country. This disturbance moved slowly eastward, and, besides the high winds detrimental to navigation, it caused a rainy period of several days that, on the whole, was very beneficial to agricultural interests; but along the northern slope of the Blue Mountains the rains were excessive, and much damage was done by floods in the small streams rising in those mountains.

Both the Umatilla and the Walla Walla rivers overflowed their banks and inundated the neighboring lowlands. Many bridges were washed away or seriously weakened, and numerous washouts occurred along the track of the Oregon Railroad and Navigation Company between Meachem and Umatilla. Railway traffic over this stretch of road was entirely suspended for several days. The cities of Pendleton, Oreg., and Walla Walla, Wash., were greatly inconvenienced by floods and some property was damaged, but the losses were not heavy.

Frosts occurred frequently in the intermountain section of the district, for all of which timely warnings were issued.

Although May is the month for high water in the Columbia River, due to the melting of snow in the Rocky Mountains, the river rose very slowly, and at the close of the month it was below the danger stage at all points where observations are taken.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

River conditions were comparatively quiet and uneventful during the month. The crest of the April rise in the lower Mississippi River reached Baton Rouge on the 1st and New Orleans on the 3d, and by the 7th a general fall was in progress. There was a moderate flood in the Arkansas portion of the Red River from the 6th to the 13th, with a maximum stage of 31.2 feet at Fulton, Ark., 3.2 feet above the flood stage. The flood was well forecast by warnings issued on the 3d and 6th, and extended only a short distance below Fulton. A flood of similar character also occurred in the Chickasawhay River of Mississippi about the same time. The warnings, issued a few days in advance, were fully justified, and proved of much value to interests affected by flood waters. Heavy rains during the first ten days of the month over the headwaters of the Rio Grande caused a general rise in that river below the mouth of Rio Chama, for which advices were issued on the 13th. There were additional rains from the 19th to the 21st, inclusive, necessitating advices of a similar character on the 23d. The crest stages were in both instances somewhat below the flood lines.

The highest and lowest water, mean stage, and monthly range at 283 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown

on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Professor of Meteorology.*

CLIMATOLOGICAL SUMMARY.

By Mr. JAMES BERRY, Chief of the Climatological Division.

TEMPERATURE AND PRECIPITATION BY SECTIONS, MAY, 1906.

In the following table are given, for the various sections of the Climatological Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

The mean temperatures for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperature and precipitation are based only on records from stations that have ten or more years of observation. Of course the number of such records is smaller than the total number of stations.

Section.	Temperature—in degrees Fahrenheit.								Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.						Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest.	Date.			Station.	Amount.	Station.	Amount.
Alabama	69.7	— 2.1	Flomaton	97	18	Valley head	31	10	4.63	+1.16	Pushmataha	9.18	Daphne	1.97
Arizona	66.5	— 2.3	Roosevelt	109	19	Grand Canyon	20	12	0.11	—0.18	Williams	0.62	16 stations	0.00
Arkansas	68.8	— 0.8	Lacrosse	100	30	Harrison	28	9	4.71	—0.17	Russellville	10.31	Rogers	0.71
California	59.8	— 2.7	Mammoth Tank	108	8	Bodie	14	28	3.19	+1.78	Fordyce Dam	12.46	8 stations	0.00
						Tamarack	14	12						
Colorado	51.9	0.0	Holly	99	16	Breckenridge	12	6, 7	1.77	—0.16	Collbran	4.29	Manassa	0.05
Florida	75.2	— 0.6	Orange City	99	2	Molino	38	11	6.96	+3.39	Middlesburg	17.13	Pensacola	1.74
			Mariana	99	21	Johnstown	38	11						
Georgia	70.2	— 2.0	Brunswick	99	20	Clayton	29	10	4.32	+1.04	Screven	11.57	Tallapoosa	0.86
Hawaii	72.0	.....	2 stations	92	2 dates	2 stations	50	8 dates	5.01	.....	Kakalau, Hawaii	20.73	Mana Pump, Kauai	0.14
Idaho	52.0	— 0.5	Garnet	93	9	Soldier	14	18	3.15	+0.94	Westlake	6.38	Hotsprings	0.81
Illinois	64.0	+ 0.8	Cisne	95	24	La Harpe	26	7	2.70	—1.34	Dixon	7.24	Cairo	0.46
			Equality	95	18									
Indiana	63.7	+ 0.9	Logansport	98	24	Auburn	26	10	2.29	—1.76	Rockville	5.36	Mount Vernon	0.57
Iowa	60.8	+ 0.1	Odeboldt	95	11	Britt	24	7	3.54	—0.70	Hanlontown	10.72	Elliott	0.89
						Estherville	24	7						
						Iowa Falls	24	7						
Kansas	65.0	+ 0.8	Independence	99	31	Lebanon	25	6	2.62	—1.90	Yates Center	9.95	Norton	0.65
Kentucky	65.9	— 0.3	Maysville	95	17	Eubank, Shelby City	31	8	2.54	—1.51	Catlettsburg	5.10	Williamstown	0.63
			Highbridge	95	18	Owenton, Williamstown.	31	9						
Louisiana	73.9	— 0.3	Ruston	100	27	Liberty Hill	40	10	2.10	—1.30	Covington	5.86	Cameron	T.
						Robeline	40	10						
Maryland and Delaware	63.4	+ 0.2	Milford, Del.	97	18	Deer Park, Md.	22	8	2.72	—0.95	Seaford, Del.	4.86	Pocomoke City, Md.	1.06
Michigan	53.9	— 0.3	Marquette	91	17	Wetmore	12	20	2.89	—0.52	Isle Royale	6.74	Petoskey	0.75
Minnesota	53.7	— 1.7	Halstad	93	11	Hallock	14	6	5.58	+2.17	Minneapolis †	10.90	Worthington	1.04
			Moorhead	93	11									
Mississippi	70.4	— 2.1	Pearlington	98	18	Ripley	34	10	4.92	+1.29	Quitman	10.34	Bay Saint Louis	0.45
Missouri	66.3	+ 1.0	Caruthersville	98	30	Bethany	27	9	2.16	—2.90	Dean	7.85	Cape Girardeau	0.31
Montana	50.2	— 2.0	Billings	96	10	Fallon	9	6	4.06	+1.92	St. Pauls	9.27	Troy	1.88
Nebraska	60.2	+ 0.7	Lynch	97	11, 13	Agate	20	6	2.78	—0.90	Blair	7.07	Mason City	0.33
Nevada	53.1	— 1.3	Logan	98	8	Squaw Valley	14	17	1.38	+0.32	Palmetto	3.44	Logan	T.
New England *	55.1	— 0.4	Plymouth, N. H	96	18	Fort Fairfield, Me	21	3	4.96	+1.35	Nashua, N. H	7.22	Van Buren, Me	1.90
			Norfolk, Mass	96	18									
New Jersey	61.0	+ 0.6	Belvidere ‡	94	18	Layton	24	11	4.21	+0.38	Canton	6.28	Clayton	2.37
New Mexico	60.5	— 1.1	Carlsbad	101	28	Luna	18	1	0.50	—0.48	Los Alamos	1.87	Cambray	0.00
			San Marcial	101	18								Palma	0.00
New York	55.8	— 0.5	Lake George	95	18	Indian Lake	20	21	3.99	+0.60	Easton	9.18	Paul Smiths	0.89
North Carolina	66.4	— 1.1	Kingston ‡	98	18	Pink Beds	23	10	3.01	—1.42	Buckspring	11.95	Hatteras	0.55
North Dakota	50.8	— 2.3	Dunseith ‡	99	11	Milton	11	6	4.63	+2.25	Fullerton	8.08	Edmore	2.35
Ohio	61.3	+ 0.1	Amesville ‡	94	17	Bellefontaine ‡	24	10	2.17	—1.46	Frankfort	3.58	Tiffin	0.88
Oklahoma and Indian Territories.	68.8	— 0.1	Arapaho, Okla	98	29	Jefferson, Okla.	32	9	3.22	—2.43	South McAllister, Ind. T.	7.46	Fort Gibson, Ind. T.	0.20
Oregon	53.8	— 0.6	Blalock	97	9	Bend ‡	21	16	3.33	+0.70	Gold Beach	11.07	Heisler	0.20
Pennsylvania	60.0	+ 0.2	Marion	99	27	Dushore ‡	23	11	3.23	—1.01	Emporium	5.59	Hyndman	0.93
Porto Rico	77.1	.....	Caguas	98	25–28	Adjuntas	51	7	4.69	.....	Añasco	11.17	Coamo	0.23
			Manati	98	22–26, 28, 29									
South Carolina	70.7	— 1.5	Florence	99	19	Seivern	30	10	3.00	—0.43	Calhoun Falls	5.50	Bowman	1.69
South Dakota	56.6	— 0.4	Castlewood	99	11	Bellefourche ‡	22	5	4.95	+1.91	Aberdeen	12.39	Howard	2.09
			Fairfax	99	15	Millbank ‡	22	7						
Tennessee	66.6	— 0.7	Cedar Hill	95	16	Hohenwald ‡	27	10	3.27	—0.62	Andersonville	5.69	Charleston	1.26
						Rugby ‡	27	8						
Texas	73.3	— 0.2	Fort McIntosh	109	5	Rhineland	34	6	2.98	—0.60	Hondo City	9.09	Alvin	0.06
Utah	55.1	— 2.2	Thistle	96	21	Kelton	13	10	1.98	+1.18	Ogden (No. 1)	5.63	Lucin	T.
Virginia	64.2	— 0.5	Arvonia	97	18	Burkes Garden	22	11	2.98	—1.09	Roanoke	5.17	Blacksburg	1.28
Washington	55.2	0.0	Zindel	99	9	Northport	21	5	3.03	+0.88	Quinlault	6.86	Sixprong	0.67
West Virginia	62.7	0.0	Berkeley Springs	98	18	Nuttallburg	22	10	2.59	—1.75	Bens Run	6.89	Oceana	0.39
Wisconsin	54.9	— 1.6	Viroqua	91	17	Osceola	16	8	4.39	+0.54	Downing	8.44	Racine	1.50
			Brodhead	91	17									
Wyoming	48.4	— 0.6	Hyattsville	95	12	Snake River, Y. N. P.	0	1	3.05	+0.99	Afton	6.50	Basin	1.10

* Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. † Cooperative station. ‡ Same reading occurred at other stations.

THE WEATHER OF THE MONTH.

By Mr. P. C. DAY, Assistant Chief, Division of Meteorological Records.

PRESSURE.

The distribution of atmospheric pressure for the month over the United States and Canada is graphically shown on Chart VI, and the average values and departures from the normal are shown for each station in Tables I and V.

No marked variations from the normal occurred, except that the Atlantic high area that normally impinges slightly on the south Atlantic coast during May, extended much farther inland during the current month and covered the entire region from the lower Mississippi Valley eastward, and northward nearly to the Great Lakes. The pressure over the region named, and extending northward into Ontario and southwestward over Texas, was decidedly above the normal.

Over the New England States and the Canadian Maritime Provinces pressure was lower than the average, and also generally over the upper Missouri Valley and westward and southwestward to the Pacific Ocean.

TEMPERATURE.

The extension of the north Atlantic high area westward over the Gulf States gave to that region temperatures below the normal, as also southward over the Florida Peninsula. North and west of the region of highest pressure the modifying influence of the southerly and easterly winds was felt as far north as the Lake region and west to the Rocky Mountains. From the Lake Superior region west and north over the Canadian Northwest Provinces and over the entire region west of the Rocky Mountains temperatures were lower than the average. In the great valley of California the temperature averaged markedly low; at Fresno the average daily deficiency was nearly 5°. The temperature was also below the normal over the greater portion of New York and the northern New England States.

Minimum temperatures, decidedly low for the season, occurred over nearly all sections east of the Mississippi River from the 9th to 10th; freezing weather, with killing frosts, occurred throughout the central valleys and eastward to the Middle Atlantic coast districts, and heavy frost extended well into the northern part of the Gulf States.

PRECIPITATION.

Heavy local rains occurred over extreme northeastern Florida, in north-central Texas, over central New England, and in the upper Mississippi and Missouri valleys. Over practically all the region west of the Rocky Mountains and in the upper Missouri Valley the monthly amounts were decidedly above the average. At Jacksonville, Fla., the total fall was more than 10 inches above the normal, at St. Paul and Minneapolis, Minn., about 7 inches, and over portions of Idaho, Washington, Oregon, and California amounts from 2 to nearly 4 inches above normal were measured. There was a decided deficiency in precipitation over the Lake region, the greater part of the Middle Atlantic States, the Ohio and lower Mississippi and Missouri valleys, and over the greater portion of Texas, New Mexico, Colorado, and Arizona. In eastern North Carolina the total rainfall was but little more than 10 per cent of the normal, while in portions of Kansas, Oklahoma, and Texas it did not exceed 20 to 30 percent of the average.

The amounts of snowfall for the month are shown on Chart VII. The depths recorded were generally small, except over the northern Rocky Mountain section, where locally heavy falls occurred; also over the high levels of the Sierra Nevada Mountains, where depths from 20 to 50 inches were recorded.

In Canada.—Prof. R. F. Stupart says:

The temperature was from average to 1° above in British Columbia, from average to a little above in counties contiguous to the western portion of Lake Ontario, 1° above at a few places in New Brunswick and Nova Scotia, and below elsewhere. In the Northwest Provinces the negative departure ranged from 1° to 5°.

The precipitation was deficient over the northern portions of British Columbia and the Northwest Provinces, also from Lake Huron to northern New Brunswick; elsewhere in Canada an excess occurred. The precipitation over the Northwest Provinces was remarkable, southern districts having more than double the average amount, whilst in northern localities there was a deficiency. The rainfall of seven inches at Calgary, which exceeded the average by nearly five inches, was particularly remarkable.

The average and extreme values of the principal climatological data are given for each station in Tables I–VI, but the averages by districts are summarized in the following tables:

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	9	53.7	— 0.7	+ 4.9	+ 1.0
Middle Atlantic	13	62.7	+ 0.7	+ 5.2	+ 1.0
South Atlantic	10	69.4	— 0.5	— 0.5	— 0.1
Florida Peninsula *	8	76.1	+ 0.1	— 1.6	— 0.3
East Gulf	8	70.9	— 1.5	— 8.2	— 1.6
West Gulf	7	72.8	+ 0.3	— 3.4	— 0.7
Ohio Valley and Tennessee	12	65.1	+ 0.5	— 0.7	— 0.1
Lower Lake	8	56.8	0.0	+ 5.9	+ 1.2
Upper Lake	10	51.8	— 0.1	+ 9.7	+ 1.9
North Dakota *	8	50.1	— 2.0	+ 14.6	+ 2.9
Upper Mississippi Valley	13	61.5	+ 0.5	+ 4.5	+ 0.9
Missouri Valley	11	62.2	+ 2.1	+ 11.1	+ 2.2
Northern Slope	7	52.8	— 0.6	+ 10.7	+ 2.1
Middle Slope	6	63.4	+ 1.3	+ 5.6	+ 1.1
Southern Slope *	6	68.5	— 0.3	— 3.4	— 0.7
Southern Plateau *	13	62.9	— 2.0	+ 4.2	+ 0.8
Middle Plateau *	8	54.3	— 0.9	+ 3.4	+ 0.7
Northern Plateau *	12	53.9	— 0.7	+ 8.2	+ 1.6
North Pacific	7	53.2	— 0.6	+ 8.4	+ 1.7
Middle Pacific	5	57.2	— 1.4	+ 9.2	+ 1.8
South Pacific	4	60.2	— 2.2	+ 3.8	+ 0.8

* Regular Weather Bureau and selected cooperative stations.

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	9	4.54	128	+1.0	—0.2
Middle Atlantic	13	3.19	89	—0.4	—2.6
South Atlantic	10	4.14	105	+0.2	—3.3
Florida Peninsula *	8	7.01	206	+3.6	+3.9
East Gulf	8	3.69	92	—0.3	—4.3
West Gulf	7	3.38	75	—1.1	—6.3
Ohio Valley and Tennessee	12	2.74	69	—1.2	—6.1
Lower Lake	8	1.86	54	—1.6	—4.8
Upper Lake	10	2.52	76	—0.8	—1.2
North Dakota *	8	5.04	237	+2.9	+1.9
Upper Mississippi Valley	13	4.37	105	+0.2	+0.1
Missouri Valley	11	2.98	71	—1.2	—0.6
Northern Slope	7	3.20	139	+0.9	+1.2
Middle Slope	6	1.86	51	—1.8	—1.5
Southern Slope *	6	2.62	70	—1.1	—0.1
Southern Plateau *	13	0.56	100	0.0	+2.0
Middle Plateau *	8	1.86	175	+0.8	+3.5
Northern Plateau *	12	2.93	160	+1.1	+0.2
North Pacific	7	2.59	93	—0.2	—7.8
Middle Pacific	5	2.26	195	+1.1	+4.3
South Pacific	4	2.21	539	+1.8	+6.4

* Regular Weather Bureau and selected cooperative stations.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	73	— 5	Missouri Valley	64	— 1
Middle Atlantic	66	— 6	Northern Slope	67	+ 9
South Atlantic	73	— 1	Middle Slope	63	+ 2
Florida Peninsula	79	+ 3	Southern Slope	58	— 3
East Gulf	73	+ 2	Southern Plateau	40	+ 8
West Gulf	74	— 1	Middle Plateau	50	+ 4
Ohio Valley and Tennessee	66	— 2	Northern Plateau	57	+ 1
Lower Lake	68	— 3	North Pacific	79	+ 3
Upper Lake	71	— 1	Middle Pacific	76	+ 5
North Dakota	72	+10	South Pacific	74	+ 5
Upper Mississippi Valley	67	— 1			

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Block Island, R. I.	29	59	ne.	Mount Tamalpais, Cal.	22	52	nw.
Columbus, Ohio	8	52	w.	Mount Weather, Va.	31	52	nw.
Duluth, Minn.	18	54	w.	Nantucket, Mass.	28	50	ne.
Lexington, Ky.	31	54	sw.	Do	29	55	ne.
Louisville, Ky.	31	52	nw.	North Head, Wash.	25	70	se.
Memphis, Tenn.	3	51	w.	Do	26	60	se.
Do	5	60	sw.	Point Reyes Light, Cal.	11	54	nw.
Minneapolis, Minn.	26	52	ne.	Do	12	52	nw.
Modena, Utah	28	58	sw.	Do	14	50	nw.
Mount Tamalpais, Cal.	11	52	nw.	Do	15	56	nw.
Do	14	58	nw.	Do	20	61	nw.
Do	15	60	nw.	Do	21	65	nw.
Do	16	58	nw.	Do	22	68	nw.
Do	19	60	nw.	Do	23	56	nw.
Do	20	59	nw.	Do	25	54	s.
Do	21	57	nw.	Sand Key, Fla.	28	54	sw.

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.3	— 0.2	Missouri Valley	5.4	0.0
Middle Atlantic	4.5	— 0.7	Northern Slope	5.6	+ 0.2
South Atlantic	4.5	+ 0.1	Middle Slope	4.8	0.0
Florida Peninsula	5.0	+ 0.5	Southern Slope	4.4	— 0.1
East Gulf	4.7	+ 0.4	Southern Plateau	2.4	+ 0.2
West Gulf	4.8	— 0.1	Middle Plateau	4.4	+ 0.3
Ohio Valley and Tennessee	4.8	— 0.3	Northern Plateau	5.4	— 0.2
Lower Lake	5.6	+ 0.4	North Pacific	6.8	+ 0.9
Upper Lake	5.9	+ 0.4	Middle Pacific	4.9	+ 0.7
North Dakota	6.7	+ 1.4	South Pacific	4.8	+ 0.6
Upper Mississippi Valley	5.1	— 0.1			

DESCRIPTION OF TABLES AND CHARTS.

By Mr. P. C. DAY, Assistant Chief, Division of Meteorological Records.

For description of tables and charts see page 38 of REVIEW for January, 1906.

TABLE I.—*Climatological data for U. S. Weather Bureau stations, May, 1906.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.			Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
New England.							53.7	— 0.7									73	4.54	+ 1.0										
Eastport	76	69	85	29.80	29.88	— .08	46.9	— 0.6	67	31	54	35	4	40	26	43	39	79	5.63	+ 1.9	17	7,329	s.	40	se.	9	6	13	12	5.3
Portland, Me.	103	81	117	29.82	29.95	— .02	51.7	— 1.9	85	19	59	36	11	44	33	46	41	72	4.79	+ 1.2	12	6,874	s.	37	se.	9	9	6	16	6.2
Concord	288	70	79	29.63	29.94	— .04	55.3	— 1.3	90	18	67	30	4	43	39	....	....	....	5.44	+ 2.2	14	4,039	nw.	24	nw.	1	17	7	7	3.8	T.
Burlington	404	12	47	29.52	29.96	— .01	52.2	— 6.3	87	18	61	30	21	43	34	....	....	....	2.83	— 0.2	13	8,168	s.	44	s.	12	5	9	17	6.9	T.
Northfield	876	16	70	29.01	29.96	— .01	50.7	— 3.0	88	18	63	25	21	39	42	47	42	72	4.57	+ 1.8	15	6,077	s.	36	se.	2	4	11	16	6.9	T.
Boston	125	115	188	29.82	29.96	— .02	58.0	+ 1.5	86	19	67	38	11	49	31	51	45	67	4.91	+ 1.3	12	7,576	sw.	37	s.	9	13	11	7	4.2	
Nantucket	12	14	90	29.95	29.96	— .03	54.2	+ 1.7	79	19	62	40	15	47	24	50	47	80	2.36	— 1.2	7	12,146	sw.	55	ne.	29	17	8	6	4.6	
Block Island	26	11	46	29.94	29.97	— .02	54.2	+ 1.8	75	19	61	42	10	48	19	50	48	84	5.03	+ 1.3	9	12,290	sw.	59	ne.	29	14	13	4	4.2	
Narragansett	.....	9	....	.....	.....	.....	54.7	+ 0.1	81	19	64	35	11	46	26	....	....	....	5.14	+ 1.1	9	.....	sw.	....	....	..	19	5	7	....	
Providence	160	57	67	29.80	29.97	— .01	57.6	.....	89	19	68	37	11	48	31	50	45	67	4.51	.....	11	5,560	w.	27	w.	3	15	9	7	4.7	
Hartford	159	122	132	29.80	29.97	— .01	59.2	.....	89	18	70	35	11	48	36	52	48	70	4.60	.....	11	6,293	s.	36	sw.	13	7	15	9	5.9	
New Haven	106	116	155	29.86	29.97	— .02	58.7	+ 1.1	88	18	69	37	11	49	32	52	48	70	4.75	+ 1.1	10	7,125	s.	35	n.	28	12	10	9	4.9	
Mid. Atlantic States.							62.7	+ 0.7									66	3.19	— 0.4										4.6	
Albany	97	102	115	29.86	29.96	— .02	58.6	— 0.7	93	18	69	36	11	48	35	51	45	64	3.90	+ 0.7	12	6,254	s.	26	n.	24	13	8	10	5.2	
Binghamton	875	79	90	29.05	29.98	.00	57.2	+ 0.2	88	18	68	32	21	47	38	....	....	....	3.67	+ 0.4	12	4,687	w.	24	w.	12	7	8	16	6.6	T.
New York	314	108	350	29.64	29.97	— .02	61.8	+ 2.3	86	18	70	40	11	53	30	55	51	71	4.67	+ 1.5	12	8,805	s.	48	w.	3	15	7	9	4.5	
Harrisburg	374	94	104	29.60	30.00	+ .02	62.4	+ 2.2	90	18	72	37	10	52	31	54	47	61	1.28	— 3.4	10	5,196	sw.	33	w.	11	10	13	8	4.1	
Philadelphia	117	116	184	29.88	30.00	+ .01	64.0	+ 2.0	93	18	74	40	10	54	29	56	49	63	4.43	+ 1.2	10	8,081	sw.	33	n.	19	12	11	8	4.9	
Scranton	805	111	119	29.12	29.98	.00	59.1	.....	90	18	69	36	11	49	36	52	47	67	2.68	.....	10	5,884	sw.	34	nw.	16	11	10	10	5.3	
Atlantic City	52	37	48	29.95	30.01	+ .03	59.0	+ 1.8	91	19	66	37	10	52	29	54	50	75	3.56	+ 0.8	10	6,499	sw.	27	ne.	29	11	11	9	4.7	
Cape May	17	48	52	30.01	30.03	+ .04	59.8	+ 1.2	86	19	66	43	10	54	26	55	....	....	3.32	+ 0.2	6	6,414	s.	24	w.	31	12	14	5	4.0	
Baltimore	123	69	117	29.87	30.00	+ .01	65.1	+ 0.9	94	18	75	38	10	55	31	56	49	60	2.73	— 1.0	7	5,863	nw.	29	sw.	31	10	11	10	5.2	
Washington	112	59	76	29.88	30.00	.00	64.4	+ 0.5	92	18	75	33	11	53	34	56	50	63	1.80	— 2.1	9	4,849	s.	28	w.	5	17	7	7	3.9	T.
Cape Henry	18	11	58	29.99	30.01	+ .01	65.6	+ 1.1	91	19	74	43	11	58	32	....	....	....	2.05	— 2.0	7	9,893	s.	48	nw.	28	18	7	6	3.6	
Lynchburg	681	83	88	29.28	30.02	+ .02	65.2	— 0.8	93	18	77	34	11	53	43	58	52	66	3.18	— 0.7	7	2,990	sw.	22	nw.	9	17	10	4	4.1	
Mount Weather	1,725	10	57	28.21	30.01	+ .01	60.3	.....	86	18	70	31	10	51	28	52	45	62	2.14	.....	9	11,513	nw.	52	nw.	31	14	11	6	4.5	T.
Norfolk	91	102	111	29.92	30.02	+ .02	67.0	+ 0.6	92	18	76	43	10	58	30	59	55	69	4.99	+ 0.7	11	6,642	s.	36	w.	2	17	8	6	3.8	
Richmond	144	145	153	29.88	30.03	+ .04	67.0	+ 0.2	94	18	78	39	10	56	36	....	....	....	3.37	— 0.3	7	6,237	s.	29	w.	19	18	9	4	3.1	
Wytheville	2,293	40	47	27.68	30.03	+ .04	60.3	— 1.8	84	18	72	30	11	48	37	55	52	77	1.71	— 2.1	12	3,774	w.	26	w.	1	14	12	5	3.7	T.
S. Atlantic States.							69.4	— 0.5									73	4.14	+ 0.2										4.6	
Asheville	2,256	53	75	27.71	30.03	+ .04	62.0	— 0.7	86	31	73	32	10	51	33	55	52	76	2.83	— 0.7	9	5,103	se.	31	sw.	2	11	10	10	5.2	
Charlotte	773	68	76	29.21	30.04	+ .05	67.8	— 0.6	91	18	78	38	10	58	28	59	55	63	3.66	— 0.7	11	4,678	ne.	36	w.	27	12	9	10	5.1	
Hatteras	11	12	47	30.02	30.03	+ .02	68.6	+ 2.2	86	19	75	50	10	62	22	64	62	82	0.55	— 4.0	8	10,212	sw.	38	n.	29	19	10	2	3.1	
Raleigh	376	71	79	29.63	30.02	+ .03	68.4	+ 0.9	95	18	80	38	10	57	33	59	53	62	1.73	— 2.7	10	4,887	sw.	22	nw.	3	15	9	7	3.9	
Wilmington	78	81	91	29.93	30.01	.00	69.4	— 0.3	93	19	78	42	10	60	31	62	59	75	3.60	— 0.6	8	6,543	sw.	33	e.	23	12	18	1	3.6	
Charleston	48	14	92	29.97	30.02	+ .01	71.6	— 0.8	92	19	78	47	10	65	25	65	62	78	2.91	— 1.1	9	9,998	e.	48	ne.	23	12	12	7	4.6	
Columbia, S. C.	351	41	57	29.64	30.01	+ .01	70.2	— 2.2	93	19	81	40	10	60	29	61	56	66	2.25	— 1.6	8	5,244	sw.	30	sw.	6	16	4	11	4.7	
Augusta	180	89	97	29.82	30.01	+ .02	71.1	— 0.9	95	19	81	40	10	61	30	63	58	67	4.01	+ 0.6	8	5,089	se.	28	nw.	6	16	3	12	5.6	
Savannah	65	81	89	29.95	30.02	+ .02	72.0	— 0.9	93	2	80	47	10	64	28	65	62	78	5.50	+ 2.6	15	6,586	e.	33	e.	22	13	8	10	4.9	
Jacksonville	43	101	129	29.94	29.98	— .02	73.2	— 1.7	91	1	80	49	11	66	23	67	64	78	14.31	+10.3	12	8,477	ne.	37	sw.	7	11	11	9	5.3	
Florida Peninsula.							77.4	+ 0.3									79	5.68	+ 2.1										5.0	
Jupiter	54	10	48	29.96	29.96	— .02	77.4	+ 1.7	89	5	84	68	19	71	17	72	70	81	7.04	+ 1.8	16	9,014	sw.	36	w.	27	4	20	7	5.8	
Key West	22	10	53	29.93	29.95	— .02	78.8	— 0.6	87	27	82	70	13	74	16	73	71	79	5.23	+ 2.1	6	7,615	ne.	40	sw.	28	13	9	9	5.0	
Sand Key	25	40	71	29.92	29.95	— .02	78.8	.....	91	8	82	69	12	75	15	....	....	....	5.88	.....	8	10,466	e.	54	sw.	28	15	8	8	4.5	
Tampa	35	79	96	29.93	29.96	— .03	75.9	— 0.1	91	31	84	55	11	68	36	69	66	77	4.77	+ 2.3	13	6,545	ne.	37	nw.	20	8	15	8	4.9	
East Gulf States.							70.9	— 1.5									73	3.60	— 0.3										4.7	
Atlanta	1,174	190	216	28.79	30.02	+ .03	68.2	— 0.6	89	1	77	41	10	59	26	60	55	68	3.47	+ 0.3	6	9,095	nw.	40	nw.	9	13	10	8	4.8	
Macon	370	55	66	29.63	30.02	+ .03	71.4	— 1.2	94	1	81	42	10	61	32	....	....	....	1.65	— 1.0	6	3,949	ne.	21	ne.	22	12	9	10	5.3	
Thomasville	273	8	57	29.71	30.00	+ .01	72.7	— 2.5	96	20	84	43	11	62	34	....	....	....	6.08	+ 2.5	9	4,809	ne.	27	n.	5	13	9	9	4.9	
Pensacola	56	79	96	29.94	30.00	+ .01	72.0	— 1.5	86	20	79	53	10	65	21	....	....	....	1.74	— 1.6	7	7,850	sw.	36	nw.	7	15	9	7	4.3	
Anniston	741	9	58	29.26	30.04	+ .05	68.5	— 0.6	93	1	80	35	10	56	37	....	....	....	3.16	— 1.1	10	3,763	e.	24	n.	19	12	6	13	5.5	
Birmingham	700	136	144	29.26	30.02	+ .04	69.0	— 3.9	89	19	78	42	10	60	32	....	....	....	4.97	+ 1.1	11	5,605	sw.	28	nw.	18	9	11	11	5.4	
Mobile	57	98	106	29.94	30.00	+ .01	72.4	— 1.2	93	20	81	50	11	64	26	65	62	75	3.00	— 1.3	8	4,597	s.	33	nw.	7	13	16	2	3.8	
Montgomery	223	100	112	29.77	30.02	+ .03	70.6	— 2.2	92	19	81	43	10	60	31	64	59	71	4.34	+ 0.3	12	5,052	sw.	35	w.	26	18	4	9	4.0	
Meridian	375	84	93	29.62	30.01	+ .03	68.4	— 2.0	89	19	80	41	10	57	34	....	....	....	8.24	+ 3.4	13	3,813	e.	36	w.	4	11	14	6	4.7	
Vicksburg	247	62	74	29.72	30.00	+ .03	71.6	— 1.0	90	31	81	45	7	62	27	64	60	72	3.20	— 1.7	9	4,783	e.	33	w.	26	10	15	6	4.6	
New Orleans	51	88	121	29.94	29.99	+ .02	74.9	+ 0.3	91	31	83	54	10	67	23	68	65	78	0.70	— 4.2	5	6,276	ne.	32	nw.	7	11	16	4	4.9	
West Gulf States.							72.8	+ 0.3									74	3.36	— 1.1										4.6	
Shreveport	249	77	84	29.71	29.98	+ .03	73.4	+ 0.3	93	31	84	47	7	63	29	65	61	71	3.51	— 0.7	8	5,140	se.	31	se.	15	15	11	5	4.1	
Bentonville	1,303	11	44	28.57	29.95	+ .02	65.7	.....	88	30	77	34	9	55	34	....	....	....	2.03	.....	8	5,022	s.	24	nw.	4	20	11	0	3.6	
Fort Smith	457	79	94	29.48	29.96	+ .03	69.2	+ 1.0	89	18	80	42	7	59	28	61	57	71	5.20	+ 0.5	10	6,195	e.	43	n.	31	10	14	7	4.8	
Little Rock	357	93	100	29.62	29.99	+ .04	69.4	+ 0.1	90	18	79	45	7	60	29	61	56	68	5.01	— 0.7	8	5,686	s.	45	nw.	5	10	10	11	5.5	
Corpus Christi	20	48	53	29.91	29.93	+ .03	75.7	+ 0.3	87	27	80	58	7	72	18	71	69	83	1.48	— 1.8	6	9,857	se.	31	se.	1	7	16	8	5.2	
Fort Worth	670	106	114	29.23	59.94	+ .03	71.6	— 0.5	92	4	81	47	7	62	27	....	....	....	8.24	+ 3.3	9	8,717	s.	48	nw.	31	16	12	3	3.8	
Galveston	54	106	112	29.92	29.98	+ .04	75.0	— 0.8	88	28	79	56	7	71	20	70	68	80	0.14	— 3.7	2	9,307	se.	36	nw.	26	14	15	2	4.5	
Palestine	510	73	79	29.42	29.94	+ .01	72.4	+ 1.1	91	5	82	46	7	63	26	65	61	76	2.62	— 3.2	11	5,924	se.	36	sw.	26	6	14	11	6.1	
San Antonio	701	80	91	29.18	29.90	.00	75.6	+ 0.7	98	5	86	54	7	66	31	67	63	71	0.86	— 2.4	6	5,517	se.	27	nw.	6	9	17	5	5.1	
Taylor	583	55	63	29.32	29.98	+ .02	74.4	.....	100	5	85	47	7	64	33	....	....	....	2.32	.....	8	7,505	se.	36	nw.	26	7	12	12	5.8	
Ohio Val. and Tenn.							65.1	+ 0.5									66	2.74	— 1.2										4.6	
Chattanooga	762	106	112	29.23	30.03	+ .04	68.3	+ 0.6	90	19	79	38	10	58	32	59	54	65	1.96	— 1.9	7	4,898	w.	30	nw.	6	14	11	6	4.7	
Knoxville	1,004	35	88	28.98	30.02	+ .03	66.6	+ 0.4	89	18	78	37	10	56	31	59	55	71	4.69	+ 0.8	11	4,910	ne.	32	nw.	6	8	16	7	5.3	
Memphis	399	76	97	29.61	30.03	+ .07	69.6	— 0.6	90	18	78	46	7	61	27	62	59	74	3.93	— 0.6	12	6,655	s.	60	sw.	5	16	8	7	4.0	
Nashville	546	79	91	29.46	30.04	+ .06	68.0	— 0.3	89	18	79	40	8	57	33	59	53	66	3.80	+ 0.2	7	4,084	sw.	32	w.	2	10	12	9	5.1	
Lexington	989	75	102	28.97	30.02	+ .03	64.2	+ 1.2	86	17	74	34	9	54	33	....	....	....	3.15	— 0.3	11	6,965	sw.	52	nw.	31	15	9	7	4.1	T.
Louisville	525	111	132	29.45	30.03	+ .05	67.0	+ 0.9	90	18	78	39	9	56	32	57	51	60	2.52	— 1.2	10	5,693	s.	54	sw.	31	11	12	8	4.9	
Evansville	431	72	82	29.54	30.00	+ .03	67.0	.....	89	18	78	39	7	56	32	....	....	....	1.07	.....	9	5,433	s.	31	n.	27	11	19	1	4.2	
Indianapolis	822	154	164	29.12	30.00	+ .03	64.0	+ 0.8	86	17	75	36	7	53	31	57	53	71	1.68	— 2.4	10	7,607	sw.	44	sw.	8	5	15	11	6.3	
Cincinnati	628	152	160	29.34	30.01	+ .02	65.4	+ 0.7	89	18	76	37	9	55	29	56	49	58	1.10	— 2.3	12	4,943	sw.	36	sw.	2	10	13	8	5.1	T.
Columbus	824	173	190	29.14	30.01	+ .03	62.8	+ 0.8	88	18	74	33	10	52	29	54	47	60	2.47	— 1.8	11	6,924	w.	52	w.	8	10	13	8	5.1	T.
Pittsburg	842	336	352	29.10	30.00	+ .01	62.2	0.0	86	22	72	33	10	53	31	54	49	65	2.08	— 1.3	11	7,477	sw.	47	w.	2	11	10	10	5.4	T.
Parkersburg	638	77	84	29.36	30.02	+ .03	64.5	+ 1.5	89	18	75	33	10	54	32	56	50	63	1.89	— 1.5	10	4,102	s.	28	nw.	9	18	8	5	3.8	
Elkins	1,940	41	50	28.00	30.03	+ .03	58.8	— 0.2	86	15	73	27	8	45	42	52	48	70	3.66	— 2.4	12	2,728	w.	26	w.	31	11	14	6	4.7	T.
Lower Lake Region.							56.8	0.0									68	1.96	— 1.6										5.6	
Buffalo	767	178	206	29.14	29.98	+ .01	53.5	— 0.5	82	22	61	34	10	46	35	48	43	70	1.34	— 2.1	8	10,323	sw.	48	sw.	12	5	16	10	6.3	T.
Oswego	335	76	91	29.59	29.96	— .01	53.5	— 0.5	84	18	62	32	11	45	34	49	44	72	2.79	0.0	10	7,306	s.	28	w.	10	9	12	10	5.6	
Rochester	523	81	102	29.41	29.98	+ .01	56.4	+ 0.1	86	16	66	31	11	47	33	49	43	63	1.35	— 2.0	9	6,962	sw.	41	sw.	12	11	7	13	5.8	
Syracuse	597	97	113	29.33	29.96	— .02	56.2	.....	86	18	65	33	21	47	33	....	....	....	3.10	.....	12	8,429	s.	39	sw.	12	8	15	8	5.5	
Erie	713	92	102	29.21	29.98	.00	56.2	— 0.5	81	18	64	37	8	49	30	50	45	65	1.37	— 2.5	10	8,188	w.	36	sw.	12	5	19	7	5.5	
Cleveland	762	190	201	29.17	29.99	+ .01	58.0	+ 0.3	86	18	66	35	9	50	32	52	47	70	1.81	— 1.8	15	10,554	n.	48	ne.	28	6	19	6	5.5	0.1
Sandusky	629	62	70	29.32	30.00	+ .02	59.4	+ 0.9	88	17	68	33	10	51	32	....	....	....	1.48	— 2.0	11	6,585	sw.	33	nw.	2	9	9	13	5.4	T.
Toledo	628	120	127	29.31	29.99	+ .02	59.9	+ 0.5	88	17	70	33	7	50	32	52	46	65	2.64	— 0.7	11	7,737	sw.	36	w.	8	15	7	9	4.5	T.
Detroit	730	153	193	29.29	29.99	+ .02	57.5	0.0	87	17	67	31	10	48	34	51	46	69	2.12	— 1.4	11	8,329	w.	38	sw.	8	8	11	12	6.3	T.
Upper Lake Region.							51.8	— 0.1									71	2.62	— 0.8										5.9	
Alpena	609	13	92	29.31	29.98	+ .01	49.6	+ 0.6	88	17	59	27	10	40	38	45	41	74	2.55	— 0.9	15	8,291	se.	35	sw.	12	5	18	8	5.6	0.5
Escanaba	612	40	82	29.32	29.99	+ .02	47.4	— 1.9	79	31	56	26	7	39	33	43	37	69	1.67	— 1.7	12	8,077	s.	40	w.	31	6	14	11	5.9	T
Grand Haven	632	54	92	29.28	29.96	.00	54.2	— 0.2	80	22	63	31	10	45	29	49	45	74	1.89	— 1.5	13	9,189	sw.	38	nw.	8	9	13	9	5.1	T.

TABLE I.—*Climatological data for U. S. Weather Bureau stations, May, 1906*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max.+ mean min.÷2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				
Up. Lake Reg—Con't.																													
Grand Rapids	707	121	162	29.20	29.97	.00	57.4	— 1.1	86	25	67	33	10	48	31	51	46	68	2.99	— 0.5	11	8,746	sw.	44	sw.	12	7	12	12	6.1	T.
Houghton	668	66	74	29.24	29.97	.00	47.0	.....	82	17	56	29	6	38	39	...	...	...	3.05	.....	12	5,765	e.	36	nw.	4	7	15	9	5.7	T.
Marquette	734	77	116	29.18	29.99	+ .02	47.2	— 1.8	91	17	55	30	7	39	38	42	36	67	2.58	— 0.4	13	7,704	nw.	44	sw.	18	3	12	16	6.6	0.7
Port Huron	638	70	120	29.28	29.98	+ .01	54.4	+ 1.2	86	17	64	30	10	44	36	49	44	72	2.59	— 0.8	14	8,259	ne.	45	w.	2	8	13	10	5.7	T.
Sault Ste. Marie	614	40	61	29.30	30.00	+ .05	47.2	— 0.6	81	16	56	28	10	38	36	42	38	76	2.23	0.0	13	6,664	nw.	38	nw.	4	6	11	14	6.7	0.2
Chicago	823	140	310	29.09	29.98	+ .02	59.8	+ 3.7	90	17	68	36	9	51	27	54	49	72	2.09	— 1.6	8	11,414	sw.	48	sw.	12	9	14	8	5.2	
Milwaukee	681	122	142	29.25	29.98	+ .02	54.3	+ 1.4	88	17	63	34	9	46	29	48	43	72	2.95	— 0.6	15	8,657	w.	42	se.	8	14	7	10	4.7	T.
Green Bay	617	49	86	29.28	29.94	— .01	53.7	— 0.2	85	17	64	30	9	44	36	47	42	66	2.84	— 0.5	15	9,330	ne.	46	ne.	26	8	10	18	7.1	T.
Duluth	1,133	11	47	28.72	29.95	— .01	44.8	— 2.2	77	12	53	26	7	37	29	40	36	74	3.38	— 0.3	15	11,521	ne.	54	w.	18	6	8	17	6.8	T.
North Dakota.							50.3	— 2.3										72	4.70	+ 2.4									6.7	
Moorhead	940	8	57	28.91	29.92	— .02	52.0	— 1.2	93	11	62	24	6	42	46	48	44	77	4.18	+ 1.7	18	7,261	ne.	36	nw.	17	5	9	17	6.7	T.
Bismarck	1,674	15	57	28.12	29.90	— .02	50.8	— 3.4	96	11	61	24	6	41	47	45	38	66	5.37	+ 2.9	16	11,016	nw.	47	se.	29	6	11	14	6.4	T.
Devils Lake	1,482	11	44	28.35	29.93	— .01	49.0	.....	93	11	62	17	6	36	45	44	39	72	4.05	.....	16	12,224	ne.	45	nw.	18	6	6	19	7.0	3.4
Williston	1,875	14	44	.....	29.91	— .02	49.5	— 3.7	88	11	60	21	6	39	48	...	...	...	4.55	+ 2.5	14	10,409	e.	42	e.	13	4	11	16	....	T.
Upper Miss. Valley.							61.5	+ 0.5										67	4.37	+ 0.2									5.1	
Minneapolis	.....	102	208	.....	.....	.....	55.8	— 1.0	83	11	65	31	7	46	33	...	...	...	10.33	+ 6.6	19	10,505	w.	52	ne.	26	3	11	17	....	0.1
St. Paul	837	171	179	29.01	29.91	— .03	55.8	— 1.7	82	11	65	32	7	47	31	51	46	72	10.40	+ 7.0	19	8,726	se.	43	w.	18	2	18	11	6.8	0.4
La Crosse	714	71	87	29.16	29.93	— .01	58.4	— 1.0	84	23	68	35	9	49	27	...	...	...	5.92	+ 2.6	16	5,922	s.	28	w.	5	7	12	12	6.2	T.
Madison	974	70	78	28.90	29.95	— .01	57.0	— 1.1	86	17	67	33	6	47	29	50	45	68	3.55	— 0.1	16	7,950	sw.	44	ne.	8	7	12	12	5.9	T.
Charles City	1,015	8	58	28.86	29.93	— .01	57.5	— 2.4	85	11	68	27	7	47	35	53	49	76	6.24	+ 2.2	14	6,549	se.	30	sw.	1	4	12	15	6.7	
Davenport	606	71	79	29.29	29.95	.00	62.8	+ 2.1	88	17	73	34	7	52	35	55	50	66	2.60	— 1.7	16	6,150	nw.	29	se.	26	12	14	5	4.5	
Des Moines	861	84	101	29.03	29.94	+ .01	61.9	+ 1.5	84	11	72	33	9	51	33	54	48	65	2.21	— 2.5	12	7,574	s.	36	sw.	12	5	19	7	5.6	
Dubuque	698	100	117	29.22	29.96	+ .01	60.4	+ 0.5	87	17	71	34	6	50	32	54	49	69	3.59	— 0.4	16	5,902	s.	30	se.	24	13	12	6	4.7	
Keokuk	614	64	78	29.31	29.98	+ .04	65.5	+ 2.9	90	17	77	34	*	54	30	56	51	67	1.83	— 2.2	10	6,184	sw.	35	se.	29	18	9	4	3.5	
Cairo	356	87	93	29.63	30.01	+ .05	68.1	+ 1.0	89	18	78	42	9	59	27	60	56	69	0.46	— 3.4	8	6,607	s.	34	sw.	2	6	16	9	5.6	
La Salle	536	56	64	29.40	29.98	+ .02	61.8	.....	91	23	73	34	9	50	34	...	...	...	1.85	.....	11	6,716	sw.	39	sw.	1	16	7	8	4.3	
Peoria	609	11	45	29.32	29.98	+ .02	63.0	.....	90	17	74	28	7	52	34	55	49	65	2.88	.....	13	7,124	s.	40	w.	2	17	12	2	3.5	
Springfield, Ill.	644	10	92	29.29	29.97	+ .02	64.8	+ 2.4	90	17	76	35	9	53	32	56	50	68	3.70	— 1.3	11	7,090	s.	36	w.	1	10	14	7	4.9	
Hannibal	534	75	109	29.39	29.96	+ .02	64.6	+ 1.5	89	17	75	32	7	54	32	...	...	...	3.54	— 1.8	10	7,835	sw.	48	sw.	1	11	13	7	4.9	
St. Louis	567	208	217	29.37	29.97	+ .02	67.0	+ 1.2	88	30	77	40	9	57	31	58	52	62	2.61	— 2.0	9	8,705	s.	43	nw.	1	12	9	10	4.9	
Missouri Valley.							62.2	+ 2.1										64	2.98	— 1.2									5.4	
Columbia, Mo.	784	11	84	29.13	29.94	.00	65.8	+ 1.3	90	17	77	31	9	54	35	...	...	...	2.73	— 2.2	10	6,404	s.	44	w.	1	14	12	5	3.9	
Kansas City	963	78	95	28.94	29.96	+ .04	66.9	+ 2.7	88	17	76	39	9	57	31	57	50	60	1.68	— 3.0	9	6,801	s.	29	s.	12	10	20	1	4.4	
Springfield, Mo	1,324	98	104	28.58	29.98	+ .05	64.8	+ 1.6	89	30	75	35	9	55	30	57	51	67	5.20	— 0.8	6	8,460	s.	44	w.	31	13	16	2	4.0	
Iola	984	40	47	28.92	29.95	+ .03	66.0	.....	89	18	76	33	9	56	34	...	...	...	4.38	.....	14	7,186	sw.	31	sw.	1	4	10	17	6.6	
Topeka	.....	85	89	.....	.....	.....	65.6	+ 2.2	88	17	76	38	9	55	33	...	...	...	1.00	— 4.0	8	7,945	s.	33	sw.	17	11	13	7	4.7	
Lincoln	1,189	11	84	28.64	29.89	— .02	63.4	+ 2.3	86	11	75	34	6	52	39	54	48	62	1.53	— 2.8	8	9,493	s.	38	nw.	7	7	12	12	5.7	
Omaha	1,105	115	121	28.74	29.90	— .02	63.0	+ 1.3	86	11	73	36	6	53	36	54	48	62	2.50	— 1.9	9	7,621	s.	38	n.	7	6	10	15	6.5	
Valentine	2,598	47	54	27.18	29.88	— .02	57.2	+ 1.4	90	11	69	25	6	46	40	49	42	64	4.14	+ 1.3	9	9,216	nw.	43	nw.	17	11	14	6	4.8	
Sioux City	1,135	96	164	28.69	29.89	— .03	60.6	+ 2.2	89	11	71	31	6	50	38	...	...	...	2.18	— 1.6	7	11,761	se.	48	w.	17	9	4	18	6.4	
Pierre	1,572	43	50	28.22	29.88	— .03	58.9	+ 3.3	94	11	70	29	6	48	44	50	44	64	4.28	+ 2.0	14	7,018	se.	39	nw.	17	9	12	10	5.7	T.
Huron	1,306	56	67	28.49	29.88	— .04	57.6	+ 2.5	93	11	69	29	8	46	44	51	44	67	3.02	0.0	12	9,937	se.	43	nw.	7	8	15	8	5.6	T.
Yankton	1,233	49	57	28.56	29.87	— .05	60.4	+ 1.9	92	11	71	32	6	50	40	...	...	...	4.51	+ 0.2	12	7,942	se.	35	nw.	17	5	7	19	7.0	
Northern Slope.							52.8	— 0.6										67	3.20	+ 0.9									5.6	
Havre	2,505	11	44	27.26	29.89	— .01	51.4	— 1.9	91	10	62	27	5	41	47	45	40	71	3.32	+ 1.8	14	7,566	nw.	46	w.	15	5	16	10	6.0	T.
Miles City	2,371	26	48	27.38	29.92	+ .01	54.9	— 1.5	92	10	65	26	6	45	49	47	40	65	3.84	+ 1.6	21	5,813	ne.	40	e.	19	9	7	15	6.1	T.
Helena	4,110	8	56	25.72	29.91	— .02	48.8	— 3.0	84	10	58	28	5	39	40	42	36	68	2.96	+ 1.4	16	5,140	w.	38	w.	3	3	11	17	7.1	3.9
Kalispell	2,962	8	34	26.83	29.87	— .01	51.0	.....	80	11	62	27	5	40	40	43	36	64	2.68	.....	14	4,024	w.	25	nw.	3	7	11	13	6.0	T.
Rapid City	3,234	46	50	26.50	29.89	— .01	53.1	+ 0.2	88	11	64	25	6	42	39	48	43	74	4.67	+ 1.1	15	4,269	nw.	30	s.	15	11	8	12	5.8	T.
Cheyenne	6,088	56	64	23.93	29.83	— .02	51.0	+ 0.4	77	19	64	27	5	38	37	43	36	63	1.30	— 1.0	12	7,684	s.	44	w.	29	7	14	10	5.5	0.1
Lander	5,372	26	36	24.54	29.84	— .04	51.1	+ 0.1	79	19	65	24	6	37	44	43	35	62	3.49	+ 1.2	10	3,398	sw.	32	s.	28	8	12	11	5.5	3.0
Yellowstone Park	6,200	11	48	23.78	29.85	— .06	44.8	.....	72	10	56	18	5	33	39	37	30	64	2.01	.....	18	6,163	sw.	36	sw.	20	6	18	7	5.8	1.6
North Platte	2,821	11	51	26.99	29.88	.00	59.4	+ 1.2	90	16	73	28	6	46	43	52	46	68	2.82	+ 0.1	9	5,754	se.	35	nw.	19	17	12	2	2.6	
Middle Slope.							63.4	+ 1.3										63	1.86	— 1.8									4.8	
Denver	5,291	129	136	24.64	29.82	— .02	57.4	+ 1.0	84	16	70	30	1	44	39	46	35	51	1.45	— 1.4	8	5,544	s.	36	w.	29	10	13	8	5.3	T.
Pueblo	4,685	80	86	25.19	29.81	— .02	59.6	+ 0.9	86	15	74	32	5	46	41	48	37	51	1.40	— 0.4	7	5,489	se.	45	w.	29	13	14	4	3.9	1.0
Concordia	1,398	42	47	28.45	29.91	.00	64.4	+ 2.3	85	16	75	37	6	53	35	56	50	66	1.83	— 2.2	11	6,062	s.	32	se.	29	8	20	3	5.1	
Dodge	2,509	44	54	27.31	29.87	.00	64.2	+ 1.3	91	29	77	37	9	51	36	56	52	71	1.63	— 1.6	9	9,679	se.	43	se.	12	14	15	2	4.5	T.
Wichita	1,358	78	86	28.52	29.93	+ .03	66.2	+ 2.0	91	31	77	37	9	55	32	58	52	65	3.40	— 0.9	10	7,769	s.	33	s.	12	9	17	5	5.1	
Oklahoma	1,214	10	47	28.64	29.90	+ .01	68.3	+ 0.5	89	31	78	42	7	59	27	61	57	73	1.43	— 4.0	9	13,084	s.	46	s.	12	8	17	6	5.2	
Southern Slope.							68.1	0.0										58	1.41	— 1.2									4.4	
Abilene	1,738	45	54	28.12	29.89	+ .02	71.8	— 0.4	95	27	83	37	7	61	34	62	56	64	2.60	— 1.0	9	7,657	s.	36	n.	22	5	15	11	6.0	
Amarillo	3,676	10	49	26.18	29.85	+ .01	64.4	+ 0.2	90	31	77	38	7	52	38	54	48	63	1.18	— 2.0	7	9,112	se.	35	sw.	29	22	4	5	3.2	
Del Rio	944	8	57	28.89	29.86	+ .01	77.6	.....	104	5	89	54	7	66	41	...	...	...	1.68	.....	7	7,722	se.	40	w.	17	11	11	9	5.1	
Roswell	3,578	9	57	26.23	29.78	— .04	68.0	+ 0.2	98	28	85	39	7	51	48	53	39	46	0.46	— 0.7	2	5,410	w.	29	n.	10	20	10	1	3.2	
Southern Plateau.							63.9	— 2.2										40	0.86	— 0.2									2.4	
El Paso	3,762	10	110	26.10	29.78	.00	71.3	— 1.0	95	28	86	48	1	57	40	51	32	31	0.90	+ 0.4	2	8,863	w.	48	ne.	9	21	8	2	2.2	
Santa Fe	7,013	33	39	23.21	29.78	— .03	54.6	— 1.1	78	28	68	33	1	42	32	42	29	40	0.45	— 0.6	7	6,237	sw.	36	se.	19	19	11	1	3.1	
Flagstaff	6,907	12	44	23.30	29.82	+ .04	49.4	— 2.3	74	18	65	24	30	34	44	38	28	54	0.34	— 0.9	3	6,944	sw.	41	sw.	28	19	12	0	2.9	0.3
Phoenix	1,108	50	56	28.67	29.81	+ .03	73.4	— 1.0	98	8	89	47	1	58	39	54	37	31	T.	— 0.1	0	3,687	e.	28	nw.	11	24	6	1	1.7	
Yuma	141	16	46	29.67	29.82	+ .03	73.4	— 3.7	100	8	89	50	1	58	42	58	47	46	0.08	0.0	1	4,641	w.	30	nw.	28	27	3	1	1.1	
Independence	3,910	11	42	25.87	29.81	— .03	61.4	— 4.0	84	8	75	37	29	48	34	47	32	39	0.42	+ 0.1	2	6,136	nw.	34	w.	14	16	12	3	3.4	
Middle Plateau.							54.8	— 1.2										50	1.81	+ 0.8									4.4	
Reno	4,532	56	63	25.39	29.89	— .02	52.3	— 1.8	81	8	65	28	17	40	45	42	33	56	1.02	+ 0.5	8	5,179	w.	34	sw.	14	17	8	6	3.8	T.
Winnemucca	4,344	18	56	25.53	29.90	— .01	52.6	— 1.8	84	9	67	26	17	39	44	42	32	56	1.45	+ 0.5	7	4,805	sw.	40	sw.	14	13	12	6	3.9	T.
Modena	5,479	10	43	24.52	29.81	— .01	53.6	— 0.6	77	8	68	31	6	39	42	41	28	46	1.31	+ 0.6	4	10,384	sw.	58	sw.	28	13	14	4	4.3	T.
Salt Lake City	4,366	105	110	25.50	29.83	— .03	56.3	— 1.5	82	10	67	34	17	46	34	45	34	49	3.17	+ 1.4	11	5,051	se.	31	nw.	15	15	6	10	5.1	
Durango	6,546	18	56	23.59	29.80	— .02	53.2	— 0.8	79	19	68	28	1	39	39	41	29	49	1.16	0.0	9	4,894	nw.	42	s.	28	10	15	6	4.8	
Grand Junction	4,608	43	51	25.26	29.80	— .03	60.6	— 1.0	88	19	74	39	3	47	35	47	35	46	2.74	+ 2.1	6	4,204	nw.	32	s.	28	16	8	7	4.2	T.
Northern Plateau.							55.6	— 1.5										57	3.23	+ 1.6									5.4	
Baker City	3,471	48	58	26.36	29.93	— .03	50.8	— 1.9	82	9	62	30	17	40	39	43	35	61	2.91	+ 1.0	14	5,252	n.	30	s.	25	11	13	7	5.1	0.1
Boise	2,739	78	86	27.06	29.91	— .03	55.2	— 2.9	86	9	67	34	16	44	37	45	35	54	2.77	+ 1.1	10	4,912	nw.	26	w.	29	7	13	11	5.6	T.
Lewiston	757	10	51	29.08	29.89	— .07	59.8	— 0.3	92	9	71	37	5	48	43	...	...	...	2.33	+ 0.5	13	5,126	e.	42	nw.	14	6	9	16	6.7	
Pocatello	4,477	46	54	25.38	29.86	— .03	53.3	— 1.0	81	9	64	33	5	42	37	43	33	54	3.12	+ 2.0	10	6,942	se.	37	sw.	13	13	10	8	4.4	T.
Spokane	1,929	101	110	27.86	29.90	— .06	53.8	— 1.2	89	9	66	34	5	45	44	46	37	57	3.42	+ 2.0	12	5,424	sw.	36	nw.	9	5	9	17	6.7	
Walla Walla	1,000	71	79	28.85	29.92	— .04	59.0	— 1.9	93	9	70	39	5	48	38	51	43	60	4.81	+ 3.1	9	4,900	s.	32	sw.	14	14	14	3	4.1	
N. Pac. Coast Reg.							53.2	— 0.6										70	2.59	— 0.2									6.8	
North Head	211	11	56	29.79	30.02	— .01	51.2	— 1.4	64	25	55	44	15	48	15	48	48	90	2.90	— 0.3	19	13,310	nw.	70	se.	25	5	12	14	6.5	
Port Crescent	259	12	29	29.72	30.00	— .02	49.6	— 0.8	67	8	57	33	4	43	31	...	...	...	1.53	— 1.0	11	3,654	nw.	17	ne.	26	10	7	14	5.8	
Seattle	123	185	224	29.87	30.00	— .01	54.6	— 0.7	79	8	62	41	17	47	31	49	44	71	2.64	+ 0.3	14	5,462	s.	32	w.	26	3	13	15	7.1	
Tacoma	213	113	120	29.76	29.99	— .03	54.2	+ 0.1	82	8	62	38	17	46	38	...	...	...	2.90	+ 0.4	13	4,240	sw.	30	sw.	26	4	6	21	7.4	
Tatoosh Island	86	7	57	29.90	30.00	— .01	51.0	+ 1.0	61	20	55	42	17	47	14	48	46	84	2.20	— 2.4	15	9,034	w.	46	s.	26	4	7	20	7.8	
Portland, Oreg.	153	68	96	29.83	29.98	— .05	56.9	— 0.4	89	8	66	40	4	48	37	50	45	70	2.00	— 0.4	14	4,091	nw.	26	nw.	28	8	6	17	6.6	
Roseburg	510	9	57	29.45	30.00	— .03	55.1	— 1.8	92	8	67	36	16	43	49	50	46	78	3.98	+ 2.0	13	2,806	s.	24	sw.	14	9	5	17	6.5	

TABLE I.—*Climatological data for U. S. Weather Bureau stations, May, 1906*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
Mid. Pac. Coast Reg.							57.2	— 1.4									76	2.26	+ 1.1									4.9	
Eureka	62	62	80	29.97	30.04	— .01	52.5	— 1.0	62	18	57	40	16	48	17	50	48	85	3.57	+ 0.7	12	5,869	n.	36	nw.	1	7	13	11	5.5	
Mount Tamalpais	2,375	11	18	27.52	30.00	.00	52.0	.....	78	8	58	37	15	46	24	47	43	76	3.73	.....	7	14,268	nw.	60	nw.	15	15	11	8	4.1	
Point Reyes Light	490	7	18	29.44	29.96	.....	53.2	+ 1.0	66	2	57	46	28	49	17	.....	.....	.....	1.62	— 0.3	8	17,631	nw.	68	nw.	22	12	5	14	5.9	
Red Bluff	332	50	56	29.57	29.92	— .03	63.6	— 3.4	91	4	74	42	15	53	31	55	48	64	3.11	+ 1.8	10	4,698	se.	28	w.	14	14	6	11	5.5	
Sacramento	69	106	117	29.88	29.95	+ .01	60.4	— 3.1	82	8	70	40	15	50	30	54	49	72	2.24	+ 1.3	7	6,990	s.	42	se.	25	21	3	7	3.3	
San Francisco	155	29	42	.....	.....	.....	56.2	— 0.4	72	6	63	42	16	49	22	52	49	83	2.75	+ 2.0	7	†4,947	w.	.....	.....	.....	12	11	8	5.0	
San Jose	141	78	88	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Southeast Farallon	30	9	17	29.98	30.01	.....	53.8	.....	60	18	56	48	8	52	8	.....	.....	.....	1.61	.....	6	11,586	nw.	46	s.	25	14	4	13	5.3	.....
S. Pac. Coast Reg.							63.2	— 2.2									74	2.21	+ 1.8									4.8	
Fresno	330	67	70	29.59	29.95	+ .03	63.4	— 4.6	94	8	76	42	16	51	37	53	45	58	2.88	+ 2.5	5	5,144	nw.	24	nw.	22	22	3	6	3.0	
Los Angeles	338	116	123	29.61	29.98	+ .03	66.0	— 2.1	76	31	68	48	29	52	25	54	51	79	1.02	+ 0.6	5	4,205	sw.	26	sw.	28	6	13	12	6.1	
San Diego	87	94	102	29.88	29.96	+ .01	60.0	— 0.4	70	30	65	50	1	56	19	56	53	80	0.72	+ 0.4	8	4,713	w.	23	s.	28	16	2	13	5.2	
San Luis Obispo	201	47	54	29.80	30.02	+ .02	57.4	— 1.6	77	18	66	40	22	49	34	52	49	80	4.22	+ 3.9	9	4,896	nw.	25	w.	15	14	3	14	5.0	
West Indies.																														
Grand Turk	11	6	20	29.98	29.99	— .01	80.2	.....	90	*	86	68	14	74	....	....	....	....	1.66	.....	7	.....	se.	.....	.....	.....	.....	.....	.....	.....	
San Juan	82	48	90	29.89	29.97	— .02	79.3	— 0.1	91	21	85	70	12	74	17	73	70	75	1.18	— 3.5	11	9,169	e.	31	se.	28	7	16	8	5.4	
Panama.																														
Ancon	74	.....	.....	29.76	29.83	.....	81.9	.....	93	*	89	73	*	75	20	76	75	88	10.68	.....	20	.....	.....	.....	.....	.....	.....	0	14	17	7.7	
Naos	40	.....	.....	29.79	29.83	.....	81.8	.....	93	5	88	72	2	76	19	77	76	89	7.21	.....	14	5,549	nw.	42	ne.	31	1	10	20	7.4	

* More than one date. † Record for 29½ days.

TABLE II.—*Climatological record of cooperative observers, May, 1906.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Alaga	.....	.....	.....	6.08	
Ashville	90	35	67.8	3.81	
Auburn	90	43	70.4	5.61	
Bermuda	94	39	70.8	5.51	
Boligee	95	40	70.8	6.19	
Bridgeport	.....	.....	.....	5.28	
Burkeville	.....	.....	.....	7.00	
Calera	.....	.....	.....	3.33	
Camp Hill	94†	43†	69.2†	3.35	
Cedar Bluff	.....	.....	.....	2.56	
Citronelle	93	45	71.6	4.56	
Clanton	90	38	68.2	5.33	
Cordova	90*	35	68.0	4.89	
Dadeville	.....	.....	.....	5.03	
Daphne	90	44	72.7	1.97	
Decatur	95	36	69.4	4.09	
Demopolis	.....	.....	.....	5.14	
Eufaula	90	43	69.1	6.95	
Evergreen	94	43	70.8	5.13	
Flomaton	97	40	72.7	3.65	
Florence	93	38	68.5	3.37	
Fort Deposit	92	42	71.0	5.93	
Gadsden	96	36	69.2	4.24	
Goodwater	93	40	69.7	3.85	
Greensboro	91	43	70.6	4.69	
Greenville	.....	.....	.....	4.95	
Guntersville	.....	.....	.....	3.96	
Hamilton	94	33	68.2	4.80	
Highland Home	95	43	71.6	5.75	
Letohatchie	.....	.....	.....	5.60	
Livingston	90	45	69.8	6.44	
Lock No. 4	96	35	69.3	5.04	
Lucy	96	44	71.6	5.69	
Madison Station	94	35	70.6	3.43	
Maplegrove	94	34	68.6	2.38	
Marion	94	42	71.4	4.86	
Milstead	.....	.....	.....	6.82	
Newbern	92	40	69.9	5.18	
Notasulga	.....	.....	.....	5.02	
Oneonta	91	32	67.1	3.63	
Opelika	94	41	70.1	4.78	
Ozark	95	45	72.9	6.46	
Prattville	96	38	69.4	4.99	
Pushmataha	92	39	70.4	9.18	
Riverton	96	34	67.6	3.43	
Scottsboro	90	32	67.0	3.95	
Selma	96	41	72.0	5.84	
Springhill	85	58	71.3	5.64	
Talladega	93	36	69.2	3.95	
Tallassee	.....	.....	.....	3.93	
Thomasville	92	47†	71.0*	7.02	
Tuscaloosa	94	40	69.2	4.18	
Tuscumbia	96	38	68.6	3.96	
Tuskegee	93	45	72.2	3.34	
Union Springs	91	44	71.1	6.77	
Uniontown	93	42	71.0	4.56	
Alabama—Cont'd.					
Valleyhead	90	31	65.9	4.28	
Vienna	.....	.....	.....	4.50	
Wetumpka	92	40	71.1	4.16	
Alaska.					
Chestochena	78	28	47.3	.....	
Copper Center	77	20	48.6	0.43	T.
Fort Liscum	71	28	44.0	1.36	0.5
Juneau	80	30	55.0	.....	
Kenai	79	22	44.8	0.29	
Ketchemstock	76	11	43.8	1.69	
Killisnoo	70	32	48.0	1.25	
Sitka	75	31	47.8	3.46	
Skagway	79	26	52.2	0.37	
Sunrise	76	25	45.0	2.35	
Teikhill	81	15	44.8	0.25	T.
Arizona.					
Allaire Ranch	.....	.....	.....	0.63	
Arizona Canal Co. Dam	102	46	73.6	0.00	
Aztec	107	51	80.2	0.00	
Benson	95	38	67.8	T.	
Bisbee	85	41	64.5	0.01	
Blue	90	30	60.4	0.04	
Bonita	.....	.....	.....	T.	
Bowie	95	36	69.6	T.	
Buckeye	101	37	71.0	T.	
Casagrande	107	52	79.5	0.00	
Casa Grande Ruins	.....	.....	.....	0.05	
Clifton	.....	.....	.....	T.	
Cline	94	34	67.3	0.15	
Cochise*	98	47	69.6	T.	
Congress	90	46	69.3	0.31	
Douglas	95	36	68.6	0.00	
Dudleyville	97	38	69.4	0.10	
Duncan	95	31	63.2	T.	
Flagstaff	.....	.....	.....	0.37	2.0
Fort Apache	86	31	59.6	0.10	
Fort Huachuca	90	37	65.7	T.	
Fort Mohave	105	45	76.4	0.00	
Gilabend	104	44	75.2	0.00	
Grand Canyon	70	20	47.4	0.20	
Greaterville	87	36	61.4	0.15	
Greer	.....	.....	.....	0.28	0.2
Holbrook	90	30	61.8	0.17	
Huachuca Res	.....	.....	.....	0.00	
Jerome	84	41	64.8	0.30	
Keams Canyon	80	27	55.2	0.05	
Kingman	92	38	64.8	T.	
Maricopa	104	40	75.0	0.00	
Mesa	102	44	73.3	0.00	
Mohawk Summit*	93	54	75.1	0.00	
Mount Union	80	24	53.5	0.30	
Natural Bridge	.....	.....	.....	0.43	
Nutrioso	.....	.....	.....	0.08	
Oak Springs	80	29	55.8	0.44	
Oracle	89	48	67.8	0.15	
Paradise	86	36	62.4	0.01	
Arizona—Cont'd.					
Phoenix	100	38	70.6	0.00	
Picacho*	101	60	78.8	0.00	
Pinal Ranch	.....	.....	.....	0.11	
Pinto	.....	.....	.....	T.	
Prescott	87	30	56.6	0.14	
Roosevelt	109	45	76.1	0.14	
St. Johns	85	31	60.0	0.17	
St. Michaels	81	24	54.5	0.17	
San Carlos	97	35	68.6	0.12	
San Simon	94	38	73.4	0.00	
Seligman	82	28	55.8	0.35	
Sentinel*	108	65	81.6	0.00	
Signal	97	42	69.0	0.17	
Silver Bell	95	52	74.6	T.	
Tempe	103	38	72.0	0.00	
Thatcher	93	35	66.6	T.	
Tombstone	89	44	67.1	0.10	
Tuba	86	34	61.2	0.34	
Tucson	99	37	69.7	T.	
Upper San Pedro	92	31	61.5	0.00	
Walnut Grove	.....	.....	.....	T.	
Willcox	97	31	64.8	0.00	
Williams	82	22	52.0	0.62	
Yarnell	.....	.....	.....	0.33	
Young	87	29	59.8	0.46	
Arkansas.					
Alicia	89	40	68.6	4.30	
Amity	89	40	68.4	5.73	
Arkadelphia	92	42	69.8	4.61	
Arkansas City	.....	.....	.....	7.14	
Arnett	85	34	66.0	2.33	
Batesville	94	39	69.2	4.14	
Beebranch	90	34	66.0	2.95	
Black Rock	.....	.....	.....	4.10	
Boonville	93	37	69.1	6.80	
Brinkley	98	43	70.2	10.09	
Calico Rock	.....	.....	.....	3.10	
Camden	89	43	70.3	3.96	
Center Point	93	42	72.8	3.43	
Clarendon	.....	.....	.....	7.51	
Conway	93	39	70.0	7.34	
Cornerstone	93	45	71.2	4.40	
Corning	90	38	68.0	3.08	
Dardanelle	.....	.....	.....	9.08	
Des Arc	94	45	69.2	8.94	
Dodd City	94	30	66.8	5.00	
Dutton	83	31	64.2	3.25	
Eldorado	95	42	71.0	2.28	
Eureka Springs	92	32	67.2	2.96	
Fayetteville	88	34	67.9	1.60	
Forrest City	91	42	68.9	4.98	
Fulton	.....	.....	.....	2.40	
Hardy	89	37	66.8	7.23	
Heber	91	35	67.4	3.11	
Helena	92	43	70.6	5.46	
Hope	94	43	72.4	4.73	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Arkansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Jonesboro	95	39	70.1	4.74	
Junction	96	37	70.8	3.99	
Lacrosse	100	39	69.8	2.39	
Lake Village	92	43	70.3	4.28	
Lewisville	92	43	71.0	2.28	
Lutherville	89	33	66.2	5.78	
Luxora				2.90	
Malvern	90	40	67.4	6.20	
Marked Tree				3.35	
Marvell	94	44	70.2	7.25	
Mena	87	40	68.7	5.97	
Mossville	83	36	63.4	2.37	
Newport	95	38	71.3	2.30	
Oregon	92	28	65.0	3.88	
Ozark	90	39	68.8	5.84	
Pinebluff	92	43	70.2	4.46	
Pocahontas				3.05	
Pond	87	29	66.6	2.03	
Prescott	95	43	71.6	4.36	
Princeton	92	32	69.8	4.42	
Rison	93[f]	41[e]	69.5[e]		
Rogers	89	32	66.2	0.71	
Russellville	94[i]	40[e]	68.7[f]	10.31	
Spielerville	90	41	68.2	8.63	
Stuttgart	92	42	68.8	5.89	
Texarkana	91	42	71.0	1.84	
Warren	95	43	70.7	6.83	
White Cliffs				7.28	
Wiggs	91	37	68.0	6.01	
Winchester	94	44	70.5	8.26	
Witts Springs	76[d]	34[d]	62.0[d]	4.31	
California.					
Alturas	83	25	50.0	2.46	T.
Angola	95	38	65.2		
Auburn	85	46	66.4	4.75	
Bagdad	100	56	76.8	0.00	
Bakersfield	96	41	66.1	1.56	
Barstow	93	40	63.8	0.00	
Bear Valley				11.95	5.0
Berkeley	74	44	57.6	2.56	
Bishop	84	30	57.8	0.46	
Blocksburg	87	33	53.5	5.90	
Blue Canyon	75	25	48.0		2.0
Bodie	69	14	40.0	2.40	16.0
Bowman				9.81	18.0
Branscomb	82	28	52.0	7.14	
Brush Creek	86	32	56.0	8.86	
Butte Valley				5.32	1.0
Calabasas				2.15	
Calexico	97	54	73.9	0.00	
Campbell	78	35	57.6	1.26	
Campo				0.70	
Cedarville	88	25	51.3	2.56	4.0
Chico	89	36	64.0	3.09	
Cloverdale	86	38	59.8	4.12	
Colfax	84	30	55.6	7.54	
Colusa	85	32	59.0	2.03	
Craftonville				2.64	
Crescent City	74	38	51.9	6.29	
Crockers				10.79	6.0
Cuyamaca	69	30	47.1	3.37	
Delta	92	30	61.2	7.05	
Diamond				2.90	
Dobbins	90	45	64.0	5.04	
Durham	89	34	62.4	2.80	
Elcajon	80	42	62.0	0.73	
Electra	84	41	63.4	3.89	
Elmwood	88	42	63.9	0.27	
Elsinore	86	42	63.0	0.32	
Emigrant Gap	70	33	48.4	11.90	19.0
Escondido	82	38	63.4	1.46	
Folsom	92	39	63.4	2.89	
Fordyce				12.46	51.0
Fort Bragg				4.33	
Georgetown	83	32	53.1	7.19	
Gilroy (near)	80	35	58.2	1.65	
Glendora				2.54	
Gold Run	81	35	55.0	9.30	
Grass Valley				7.80	
Greenville	86	28	51.8	4.77	
Hanford	96	41	66.4	2.06	
Healdsburg	88	35	60.8	4.34	
Heber	102	49	74.0	T.	
Hollister	77	37	57.8	1.66	
Indio	101	55	75.9	0.00	
Idylwild	76	25	49.7	2.73	
Imperial	107	50	73.9	0.10	
Iowa Hill	82	35	55.3	7.57	
Irvine				1.19	
Jamestown	86	34	60.0	5.04	
Kennedy Gold Mine				4.09	
Kentfield				7.47	
Kernville				1.87	
King City	82	33	58.0	1.53	
Laporte	75	28	46.0	11.73	30.0
Laytonville				4.73	
Le Grand	95	44	62.9	2.63	
Lemoncove	94	43	64.6	3.21	
Lick Observatory	71	28	48.6	3.15	
Livermore	84	37	59.8	1.61	
Lodi	86	40	60.3	2.71	
Lone Pine	85	32	60.2	0.18	
Los Gatos	82	39	57.2	2.98	
Lowe Observatory				3.50	
Magalia	85	23	50.4	11.14	
Mammoth	108	40	71.2	0.00	
Marysville	85	40	62.7	3.19	
Mena	100	49	74.6	0.00	
Merced	89	36	61.8	2.10	
Mercury				4.62	
Mills College				2.31	
Milo				6.53	
Milton (near)	83	40	60.7	1.64	
Mohave	95	48	65.2	T.	
Mokelumne Hill	81	37	57.0	3.82	
Mono Ranch	79	32	53.8	2.61	
Montague	90	32	55.0	0.79	
Monterio	82	34	56.7	2.38	
Monumental	87	29	50.0	12.23	10.0
Mountainview				0.69	
Mount St. Helena				6.94	
Napa	84	40	59.4	3.23	
Needles	100	55	77.6	T.	
Nellie				6.65	
Nevada City	84	31	54.0	7.47	
Newcastle	90	38	61.6	4.24	
Newman	95	40	65.3	0.88	
Niles	86	40	60.2	1.55	
Nimshew	95	40	60.2	9.37	
North Bloomfield	81	31	53.0	9.26	
Oakland	76	44	59.8	2.06	
Ojai Valley	81	40	58.6	2.35	
Orleans	102	40	64.8	4.09	
Oroville (near)	92	39	63.4	3.85	
Ozena				0.44	
Palermo	90	39	62.8	3.90	
Peachland	80	37	56.5	4.61	
Pine Crest	72	45	56.4	4.47	
Placerville	82	34	56.5	5.48	
Point Lobos	65	49	57.8	1.62	
Porterville	95	42	64.3	3.29	
Poway	78	46	63.2	1.27	
Priest Valley				3.45	
Quincy	83	28	51.2	6.65	2.0
Redding	87	41	63.4	5.31	
Redlands	86	44	61.5	0.79	
Reedley	94	42	64.3	2.66	
Represa				3.08	
Rialto	82	42	58.6	5.00	
Riovista	81	41	60.9	2.36	
Riverside	82	41	59.8	0.52	
Rocklin	87	37	61.7	3.22	
Rohnerville				2.72	
Sacramento	82	40	60.6	2.80	
Salinas	76[e]	39[e]	57.6[e]	1.46	
San Bernardino	87	41	62.6	0.96	
San Jacinto	92	41	62.7	0.57	
San Leandro	79	36	59.8	1.91	
San Miguel Island				2.93	
Santa Barbara	75	44	58.2	2.40	
Santa Clara College	82	36	59.0	1.02	
Santa Cruz	78	35	57.3	3.85	
Santa Maria	80	42	59.0	2.39	
Santa Monica	74	45	56.2	1.43	
Santa Rosa	77	34	56.6	3.31	
Shasta	96	39	64.1	6.47	
Sierra Madre	77	45	58.5	2.77	
Sisson	91	28	53.5	2.73	
Sneddens				0.80	
Sonoma				2.78	
Sonora				5.42	
Sterling	80	30	52.6	11.02	
Stockton	84	42	58.6	1.70	
Storey	90	38	60.8	2.21	
Summerdale	75	27	47.6	11.28	12.0
Summit	65	20	48.6	4.12	36.0
Susanville	79	26	51.6	1.60	
Tamarack	68	14	40.2	8.31	50.0
Tejon	87	40	65.8	1.85	
Towle	79	30	50.7	10.15	
Truckee	68	24	40.8	3.70	9.0
Tulare	90	42	63.3	2.95	
Tustin				0.99	
Ukiah	90	34	58.1	2.94	
Upland	78	42	58.8	2.65	
Upperlake	88	37	59.2	2.66	
Upper Mattole				6.30	
Vacaville	86	36	60.2	3.04	
Visalia	90	35	61.0	2.30	
Wasco	92	40	64.4	0.83	
Wasioja				2.29	
Westpoint				5.86	
West Saticoy				1.70	
Wheatland	86	40	61.8	2.73	
Willets	97	29	57.9	4.68	
Woodleaf				10.88	
Yreka				1.19	
Zenia	79	28	50.5	4.93	
Colorado.					
Akron				3.32	
Alford	78	25	55.3	1.85	T
Alamosa	79	20	51.3	0.34	
Arriba				1.06	
Ashcroft	72	18	43.4	1.38	
Blaine	88	38	61.1	1.11	
Boulder	82	32	57.4	3.37	
Breckenridge	67	12	42.6	1.00	10.3
Burlington	89	32	56.7	0.36	
Canyon	85	33	61.8	1.15	T.
Calham				1.06	
Castlerock	85	29	55.4	0.95	
Cheesman	75	33	52.8	1.06	
Cheyenne Wells	89	34	57.8	1.24	
Chromo	75	21	48.6	2.03	2.0
Clearview	67	19	44.8	1.35	9.0
Collbran	82	30	54.2	4.29	
Colorado Springs	79	32	55.2	2.42	T.
Cripplecreek				3.61	6.0
Delta	85	33	59.2	3.21	
Dunkley	74	22	46.1	1.99	4.5
Eagle	79	25	49.0	0.50	
Fort Collins	83	33	55.0	2.40	
Fort Morgan	92	32	60.0	2.38	
Fowler				1.12	T.
Frances	76	22	47.1	2.59	3.0
Fruita	86	35	57.3	2.70	
Garnett	77	19	49.7	0.38	
Gleneyre	81	26	53.8	2.91	
Glenwood Springs	80	30	51.8	1.30	
Grand Valley	84	33	56.5	2.89	
Greeley	86	32	57.4	1.91	T.
Gunnison	75	19	47.4	2.15	3.0
Hahns Peak	70	15	43.8	3.49	12.5
Hamps	80	26	54.2	0.98	
Hoehne	88	25	55.2	1.61	2.0
Holly	99	38	64.1	0.58	
Holyoke (near)	89	25	56.8	3.56	
Idaho Springs	79	25	51.7	1.77	
Lake City	71	23	47.0	1.77	
Lake Moraine	64	19	42.4	2.30	11.0
Lamar	93	36	63.3	0.99	
Laporte				1.90	
Las Animas	94	33	64.0	1.30	
Lay	80	17	48.6	2.64	
Leroy	83	28	55.4	1.96	
Longs Peak	69	18	41.8	1.45	
Mancos	79	26	52.7	2.32	2.0
Manassa	75	20	50.9	0.05	
Meeker	80	24	50.8	2.43	2.8
Montrose	80	27	52.6	1.69	
Moraine	71	24	45.6	2.03	
Pogoda	78	23	49.8	1.88	
Paonia	83	34	55.5	3.97	
Platte Canon				2.61	
Rockyford	89	35	61.2	0.59	
Saguache	78	24	50.8	1.20	
Salida	79	19	52.1	0.14	
San Louis	76	17	49.6	1.34	
Santa Clara	78	27	51.8	2.38	8.0
Sapinero	76	22	48.5	3.74	11.9
Sheridan Lake	91	31	60.2	0.68	
Silt	82	30	54.2	1.49	
Silverton	68	18	42.1	2.76	8.5
Stonewall				1.61	8.0
Sugar City				1.24	
Trinidad	85	30	58.8	1.70	
Victor	73	21	49.0	1.44	T.
Vilas				0.50	
Wagon Wheel	74	14	44.1	1.60	
Waterdale	84	31	54.9	2.03	
Westcliffe	76	23	50.6	0.50	T.
Whitepine	64	15	40.0	0.95	10.0
Wray	86	30	59.2	3.20	
Yuma				2.01	
Connecticut.					
Bridgeport	88	32	59.6	4.14	
Canton	89	28	57.0	4.43	
Colchester	89	32	57.2	5.33	
Falls Village				5.13	T.
Hawleyville	88	31	57.4	4.21	
Lake Konomoc				4.75	
New London	87	36	58.7	5.34	
North Grosvenor Dale	90	31	57.4	6.46	
Norwalk	91	29	59.2	4.87	
Southington	88	32	58.5	4.80	
South Manchester				5.17	
Storrs	87	31	56.8	5.87	
Voluntown	90	31	57.6	5.25	
Wallingford	88	35	63.3	4.58	
Waterbury	91	32	59.4	3.74	
West Cornwall	87	28	56.0	5.61	
West Simsbury				4.24	
Delaware.					
Delaware City				2.84	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Delaware—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dover	93	.....	.....	2.81	
Milford	97	34	66.0	2.42	
Millsboro	96	30	63.9	2.68	
Newark	91	35	63.2	4.13	
Seaford	92	33	63.0	4.86	
District of Columbia.					
West Washington	96	33	65.8	1.93	T
Florida.					
Apalachicola	89	52	74.0	3.44	
Archer	97	42	75.2	5.11	
Avon Park	94	60	77.2	4.44	
Bartow	95c	56c	77.7c	4.82	
Bonifay	95	45	73.2	4.54	
Brooksville	95	52	74.8	9.25	
Clermont	97	56	78.0	11.23	
De Funiak	96	45	71.4	2.95	
Deland	93	49	75.4	.....	
Eustis	94	48	75.9	5.53	
Federal Point	91	47	73.8	12.81	
Fernandina	94	52	74.4	9.12	
Flamingo	94	65	78.7	3.45	
Fort Meade	97	57	77.3	4.08	
Fort Myers	91	60	76.6	6.12	
Fort Pierce	95	62	75.8	8.26	
Gainesville	96	48	75.4	6.67	
Grasmere	93	54	77.0	.....	
Huntington	94	50	75.4	7.94	
Hypoluxo	94	65	76.6	8.42	
Inverness	91	54	75.4	4.50	
Jasper	95	40	72.8	8.74	
Johnstown	94	38	73.4	11.57	
Kissimmee	92	54	76.3	6.77	
Lake City	95	42	73.6	9.96	
Macclenny	94	40	74.2	13.38	
Madison	98s	49s	75.0s	7.06	
Malabar	95	63	77.0	8.38	
Manatee	91	56	75.3	3.38	
Marianna	99	43	73.6	6.60	
Merritt Island	91	64	76.6	10.36	
Miami	91	66	78.0	7.89	
Middleburg	97	.....	73.0	17.13	
Molino	97	38	70.4	2.90	
Monticello	96	47	73.6	5.43	
Mount Pleasant	95	.....	.....	3.10	
New Smyrna	94	63	75.3	9.09	
Nocatee	95	54	76.8	1.86	
Ocala	96	52	76.0	7.40	
Orange City	99	48	77.1	9.46	
Orange Home	94	55	76.6	5.25	
Orlando	97	51	77.1	9.40	
Rockwell	92d	50d	77.3d	7.93	
St. Andrews	90	43	72.2	2.52	
St. Augustine	92	56	74.9	10.20	
St. Leo	94	53	76.4	6.85	
Stephenville	91	39	72.6	3.35	
Switzerland	94	43	73.8	11.42	
Tallahassee	91	49	73.6	2.92	
Tarpon Springs	91	51	74.9	4.98	
Titusville	94	60	75.4	9.78	
Wausau	.....	.....	.....	3.14	
Georgia.					
Abbeville	.....	.....	.....	8.24	
Adairsville	88	37	68.2	2.99	
Albany	97	46	73.7	7.57	
Allapaha	95	44	72.2	7.26	
Americus	93	48	71.2	5.09	
Athens	86	41	67.7	3.06	
Bainbridge	98	50	74.0	7.68	
Blakely	98	44	72.7	4.67	
Bowersville	93	39	68.6	4.22	
Brunswick	97	49	74.4	7.84	
Butler	.....	.....	.....	3.68	
Camak	93	36	69.2	3.00	
Canton	.....	.....	.....	5.30	
Carlton	.....	.....	.....	4.78	
Clayton	91	29	64.2	2.84	
Columbus	96	44	72.4	2.99	
Cordele	95	41	70.2	7.56	
Covington	.....	.....	.....	2.81	
Cuthbert	92	44	72.2	5.47	
Dahlonega	87	30	65.6	5.09	
Dawson	98	43	73.4	6.77	
Diamond	90	30	65.5	4.05	
Dublin	.....	.....	.....	5.09	
Dudley	98	41	71.2	3.50	
Eastman	98	42	72.6	5.49	
Eatonton	94	36	70.3	2.38	
Elberton	94	40	70.0	3.72	
Experiment	92	38	70.0	2.21	
Fitzgerald	96	43	71.3	7.95	
Fleming	99	42	72.0	10.50	
Forsyth	95	38	72.2	2.47	
Fort Gaines	96	45	72.7	7.07	
Gainesville	90	38	67.5	2.76	
Gillsville	91	37	68.2	3.20	
Glenville	96	46	72.2	6.63	
Greenbush	90	34	68.0	3.37	
Greensboro	93	35	69.7	3.72	
Griffin	93	39	68.8	2.39	
Harrison	94	36	70.2	2.20	
Hawkinsville	98	40	71.0	3.62	
Lost Mountain	92	34	68.6	2.32	
Louisville	93	40	71.5	2.95	
Lumpkin	93	39	69.2	4.76	
Marshallville	95	39	71.2	4.09	
Mauzy	97	43	73.1	.....	
Milledgeville	94	39	71.2	1.72	
Millen	97	43	71.3	3.22	
Montezuma	.....	.....	.....	3.44	
Monticello	95	39	71.0	1.89	
Morgan	92	45	71.2	9.27	
Newnan	94	36	69.6	2.78	
Oakdale	.....	.....	.....	3.30	
Point Peter	93	36	69.3	4.26	
Poulan	93	44	71.4	7.80	
Putnam	95	40	71.2	2.18	
Quitman	94	44	72.5	8.26	
Ramsey	89	35	67.8	4.75	
Resaca	.....	.....	.....	3.45	
Rome	93	35	69.6	1.93	
St. George	96	50	73.4	10.65	
St. Marys	98	43	74.0	6.86	
Screven	95	36d	71.9	11.57	
Statesboro	95	42	72.1	4.21	
Talbotton	94	37	70.1	3.81	
Tallapoosa	91	43	70.6	0.86	
Toccoa	89	36	66.0	2.99	
Valdosta	96	42	72.6	4.81	
Valona	96	44	71.4	7.07	
Washington	90	39	68.8	4.81	
Waycross	98	45	73.5	8.40	
Waynesboro	93	40	70.3	2.27	
Westpoint	94	41	70.0	4.12	
Woodbury	94	34	68.8	1.82	
Idaho.					
American Falls	84	30	53.4	2.40	
Bannock River Cabin	78	22	48.8	4.02	
Blackfoot	82	26	52.6	2.38	
Caldwell	89	31	56.9	2.07	
Cambridge	90	28	55.6	1.97	
Chesterfield	79	24	49.6	4.12	T.
Dent	.....	.....	.....	4.48	
Dewey	72	28	45.8	2.54	15.2
Ellerslie	86	30	53.4	2.64	
Fernwood	.....	.....	.....	5.60	
Forney	82	17	47.7	2.43	
Garnett	93	35	61.9	0.95	
Grangeville	86	30	51.6	4.44	
Hot Springs	88	32	59.3	0.81	
Idaho Falls	84	26	52.5	2.99	
Kellogg	89	26	53.1	5.86	
Lake	76	16	45.6	3.60	21.0
Lakeview	84	31	54.0	3.03	
Landore	75	24	44.3	6.23	11.0
Lardo	77	21	44.9	3.77	2.0
Lost River	78	23	50.4	3.20	
Lovell	80	22	51.9	3.47	
Meadows	85	23	48.8	3.75	T.
Milner	82	28	53.8	1.52	T.
Minidoka	84	28	54.4	1.50	T.
Moscow	87	32	53.5	2.67	
Mountain Home	91	26	55.4	1.61	
Murray	87	23	52.2	3.27	T.
Nevens Ranch	.....	.....	.....	3.35	
Oakley	84	27	53.0	1.40	
Paris	61	20	41.4	2.46	0.2
Pearl	.....	.....	.....	4.33	
Pollock	90	33	59.2	2.31	
Poplars	.....	.....	.....	2.40	
Porthill	84	29	54.4	2.10	
Riddle	82	29	53.8	4.52	T.
Roosevelt	67	19	38.4	2.40	T.
St. Maries	89	28	54.4	4.35	T.
Salem	.....	.....	.....	2.63	
Salmon	83	26	52.0	1.26	T.
Soldier	81	14	47.7	4.09	
Standrod	.....	.....	.....	3.61	T.
Twin Falls	86	30	55.6	1.58	
Vernon	89	28	48.6	4.66	T.
Westlake	.....	.....	.....	6.38	
Weston	84	29	53.2	5.18	
Illinois.					
Albion	94	34	67.2	2.00	
Aledo	87	31	62.3	4.37	
Alexander	90	28	64.6	4.20	
Antioch	90	31	58.6	2.10	
Ashton	88	31	59.2	6.59	
Astoria	88	27	63.0	2.18	
Aurora	89	30	60.0	3.10	T.
Beardstown	.....	.....	.....	2.20	
Benton	92	34	68.2	1.60	
Bloomington	94	29	66.0	2.88	
Bushnell	91	30	65.0	2.23	
Cambridge	91	32	64.0	2.16	
Carlinville	90	30	65.4	2.33	
Carlyle	.....	.....	.....	1.64	
Carrollton	92	30	65.8	5.90	
Charleston	91	30	65.0	3.12	
Chester	92	40	70.3	2.58	
Cisne	95	33	68.3	0.70	
Coatsburg	90	32	65.3	2.08	
Cobden	92	35	67.0	0.67	
Colchester	91	30	65.3	2.24	
Decatur	92	29	64.3	6.73	
Dixon	91	31	60.8	7.24	
Dwight	91	33	62.6	2.07	
Equality	95	35	69.0	1.48	
Flora	91	31	66.2	0.69	
Friendgrove	89	36	65.8	1.19	
Galva	91	28	62.1	2.33	
Grafton	.....	.....	.....	4.44	
Greenville	88	35	65.2	3.04	
Griggsville	91	35	66.4	2.83	
Halfway	92	34	67.8	2.21	
Havana	93	32	66.9	1.84	
Henry	89	30	63.2	2.53	
Hillsboro	91	31	66.0	3.15	
Hoopeston	93	29	64.0	3.58	
Joliet	93	33	62.0	2.00	
Kishwaukee	90	31	59.9	3.07	
Knoxville	89	27	62.8	2.60	
Lagrange	90	32	59.6	3.42	
Laharpe	91	26	63.3	3.70	
Lanark	88	28	59.2	4.18	
Lincoln	91	34	64.7	2.30	T.
Loami	.....	.....	.....	4.81	
McLeansboro	91	36	67.0	0.50	T.
Martinsville	92	31	66.0	1.65	
Martinton	92	32	61.8	4.25	
Mascoutah	90	32	65.7	1.50	
Minonk	92	30	63.2	1.62	
Monmouth	93	30	64.4	3.11	
Morrison	87	31	61.0	5.27	
Morrisonville	88	31	64.4	2.77	
Mount Carmel	.....	.....	.....	0.82	
Mount Vernon	91	31	67.0	1.68	
New Burnside	92	31	67.4	1.66	
Olney	91	33	66.6	1.29	
Ottawa	92	34	62.8	2.37	
Palestine	92	33	66.2	1.40	
Pana	87	32	64.3	2.46	
Paris	90	33e	65.7	1.03	
Philo	90	28	62.9	4.37	
Plumhill	88	31	65.6	1.00	
Pontiac	90	32	63.8	1.77	
Rantoul	91	32	63.9	2.51	
Raum	92	34	66.4	1.99	
Riley	89	29	58.6	2.83	
Robinson	87	32	63.4	2.87	
Rockford	90	32	61.1	2.42	
Rushville	89	32	64.6	1.73	
St. Charles	90	30	59.8	2.59	T.
St. John	91	33	67.5	0.94	
Shobonier	91	31	66.6	2.30	
Streator	92	32	62.4	1.79	
Sullivan	91	31	65.2	4.42	
Sycamore	92	31	59.2	4.40	
Tilden	91	32	66.0	2.80	
Tiskilwa	92	28	62.8	2.96	
Tuscola	90	30	62.4	1.85	
Urbana	88	30	62.2	3.31	
Walnut	91	33	63.2	4.17	
Warsaw	.....	.....	.....	1.86	
Windsor	87	29	63.8	2.64	
Winnebago	90	31	59.6	4.05	T.
Yorkville	91	32	60.4	5.09	
Zion	88	30	60.0	2.72	
Indiana.					
Anderson	88	32	63.4	2.57	
Angola	89	31	61.0	2.49	T.
Auburn	93	26	60.4	2.94	T.
Bedford	87	35	64.8	1.08	
Bloomington	87	36	65.2	2.45	
Bluffton	93	27	63.7	1.84	
Butlerville	87	30	64.5	1.87	T.
Cambridge City	88	28	61.4	1.49	
Columbus	91	31	63.9	1.51	
Connersville	91	29	62.8	2.17	T.
Crawfordsville	92e	31e	64.2e	4.03	
Delphi	93	31	63.2	2.47	
Elkhart	90	33	62.2	2.02	
Farmersburg	89	33	64.7	1.47	
Farmland	88	30	62.5	2.30	
Fort Wayne	90	28	63.2	1.96	T.
Franklin	90	30	64.0	2.76	
Greencastle	88	31	63.0	3.15	
Greenfield	88	34	64.2	1.56	
Greensburg	89	32	63.7	1.55	T.
Hammond	90	32	59.8	3.74	
Holland	93	36	66.6	2.82	
Huntington	91	31	63.6	2.27	T.
Jeffersonville	91	37	66.7	2.24	
Knox	89	33	62.4	2.45	
Kokomo	90	31	62.5	2.52	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Indiana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lafayette	90	31	63.4	3.36	
Laporte	88	30	59.3	3.20	
Lima	88	29	59.7	3.41	
Logansport	98	33	63.4	1.78	
Madison	96	33	66.3	1.47	
Marengo	91	32	63.6	1.84	
Marion	92	29	64.0	2.52	T.
Markle	90	29	61.8	1.65	
Mauzy	89	26	62.2	3.59	T.
Moores Hill	93	31	64.1	0.90	
Mount Vernon	93	40	67.9	0.57	
Northfield	88	28	61.4	4.37	
Paoli	88	34	66.0	1.68	
Plymouth	90	31	61.6	2.75	
Princeton	90	32	66.1	2.00	
Rensselaer	91	32	63.0	1.95	
Richmond	90	27	61.8	1.52	
Rochester	86	35	62.6	1.48	
Rockville	87	32	63.4	5.36	
Rome	92	35	66.2	2.04	
Salamonia	88	28	62.2	3.31	
Salem	89	34	65.2	1.65	
Scottsburg	90	35	66.6	2.25	
Seymour	88	34	63.0	2.88	
Shelbyville	91	30	64.2	1.79	T.
South Bend	88	34	60.4	2.21	
Syracuse	91	30	62.8	1.51	T.
Terre Haute	89	37	66.3	3.66	
Valparaiso				2.37	
Veedersburg	90	30	63.0		
Vevay	89	34	64.8	1.60	T.
Vincennes	94	34	67.3	2.51	
Washington	90	34	65.7	1.79	
Indian Territory.					
Calvin				3.49	
Durant	93	40	70.0	6.74	
Fairland	91	33	67.8	2.69	
Fort Gibson				0.20	
Healdton	90	33	68.9	6.20	
Holdenville	91	40	68.3	2.80	
Marlow	91	42	68.8	2.46	
Muskogee	89	39	68.0	0.87	
Okmulgee	93	34	68.5	1.64	
Pauls Valley	92	36	69.2	5.50	
Ravia	92	42	70.5	4.63	
Roff	88	44	69.0	6.06	
South McAlester				7.46	
Tulsa	90	38	68.4	1.92	
Vinita	89	34	68.3	2.35	
Wagoner	90	36	69.1	1.83	
Webbers Falls	90[b]	37	68.8[c]	4.04	
Iowa.					
Afton	86	31	62.5	2.97	
Albia	85	30	61.4	2.89	
Algona	87	26	58.5	4.43	T.
Allerton	86	30	61.1	2.52	
Alta	88	29	59.0	5.12	
Alton	89	30	59.6	6.31	
Amana	88	29	62.0	2.12	
Ames	86	29	60.8	1.73	
Atlantic	86	25	61.4	2.65	
Audubon	88	27	61.2	2.86	
Baxter	85	27	60.4	2.50	
Bedford	85	26	59.7	1.45	
Belleplaine	86	27	60.4	3.06	
Bonaparte	88	28	63.6	2.92	
Boone	86	31	60.2	2.20	
Britt	87	24	58.6	4.31	T.
Buckingham				3.23	
Burlington	89	31	63.4	1.82	
Carroll	87	28	59.6	2.81	
Cedar Falls				2.75	
Cedar Rapids	90	30	62.0	3.28	
Chariton	84	31	61.2	2.23	
Clarinda	89	29	62.6	1.32	
Clearlake	83	31	58.8	6.80	
Clinton	91	30	62.5	4.44	
College Springs	85	29	62.8	1.67	
Columbus Junction	89	32	64.0	2.02	
Corning	84	29	61.2	1.91	
Corydon	86	30	62.6	2.33	
Creston	84	27	60.6	1.29	
Cumberland				1.73	
Decorah	87	29	60.0	5.56	
Delaware	83	27	58.4	2.80	
Denison	87	29	59.8	2.70	
Desoto	84	31	62.0	1.74	
Dows	86	27	58.2	4.19	
Earlham	85	26	60.2	1.70	
Elkader	89	28	60.2	3.70	
Elliott	88	29	63.8	0.89	
Estherville	90	24	58.1	3.15	
Fayette	88	25	58.0	2.84	T.
Forest City	88	27	58.4	5.17	
Fort Dodge	87	30	58.3	6.10	
Fort Madison				2.26	
Galva	81	30	59.6	4.61	
Gilman				1.83	
Glenwood	85	32	62.4	1.97	T.
Grand Meadow	84	27	58.2	4.50	
Greenfield	89	27	63.2	2.54	
Grinnell (near)	83	28	61.0	2.41	
Grundy Center	86	28	60.6	2.92	
Guthrie Center	86	29	62.2	2.11	
Hampton	88	28	59.8	3.32	T.
Hancock	85	32	61.7	3.42	
Hanlontown	86	25	57.4	10.72	
Harlan	85	28	61.0	4.89	
Hopeville	84	31	61.9	2.00	
Humboldt	82	27	57.6	6.85	
Idagrove	89	29	60.8	3.60	
Independence	85	29	60.4	1.00	
Indianola	85	31	62.4	1.93	
Inwood	93	28	58.8	5.54	
Iowa City	87	25	61.0	2.33	
Iowa Falls	86	24	58.2	2.94	
Jefferson	86	30	60.9	3.17	
Keosauqua	91	27	63.1	3.83	
Lacona				1.36	
Larrabee	89	30	61.4	4.27	
Leclaire				2.90	
Lemars	91	28	60.3	5.87	
Lenox	84	30	62.2	0.99	
Leon	84	32	62.7	1.40	
Little Sioux	88	29	63.0	4.05	
Logan	89	31	62.6	3.73	
Maple Valley				5.68	
Marshalltown	88	26	60.4	2.50	
Mason City	85	30	58.8	7.00	
Mountayr	86	31	62.8	2.79	
Mount Pleasant	91	29	64.1	1.58	
Mount Vernon	88	30	61.8	3.18	
Muscatine				8.49	
Nevada				3.57	
New Hampton	85	28	58.0	4.97	T.
Newton	86	32	63.3	2.19	
Northwood	85	28	58.0	9.61	T.
Odebolt	95	28	61.7	4.06	
Ogden	87	29	60.0	3.04	
Olin	86	25	60.8	5.01	
Onawa	91	30	63.2	4.61	
Osage	86	29	57.8	8.10	
Oskaloosa	86	28	62.8	1.85	
Ottumwa	89	32	63.9	2.40	
Pacific Junction	85	30	62.2	1.41	
Pella	88	31	64.4	2.01	
Perry	87	30	61.3	3.10	
Plover	88	27	59.8		
Pocahontas	90	28	59.9	3.05	
Redoak	87	32	64.2	0.90	
Ridgeway	87	30	58.7	6.04	
Rockwell	87	29	59.3	6.86	
Sac City	86	30	60.5	3.16	
St. Charles	84	32	62.4	2.72	
Sheldon	92	29	59.3	5.52	
Sibley	92	25	57.5	4.20	
Sigourney	88	29	63.9	3.20	
Sioux Center	89	26	58.6	8.00	T.
Stockport	87	28	62.8	1.80	
Storm Lake	85	30	58.0	4.57	
Stuart	89	31	62.2	2.01	
Thurman	87	28	63.5	1.21	
Tipton	90	32	63.6	3.12	
Toledo	86	27	61.8	3.37	
Vinton	85	27	60.8		
Wapello	89	32	63.4	2.84	
Washington	87	30	62.5	2.03	
Washta	84	26	60.1	4.28	
Waterloo	87	28	59.9	3.35	
Waukee	85	30	62.7	2.46	
Waverly	86	28	60.0	2.73	
Webster City	88	26	61.4	3.03	
Westbend	87	27	59.0	4.79	
Whitten	87	25	60.4	3.56	T.
Wilton Junction				3.79	
Winterset	86	31	63.8	2.48	
Woodburn	87	27	61.3	2.36	
Zearing	86	26	59.9	2.50	
Kansas.					
Abilene				2.66	
Alton	96	32	64.8	1.77	
Anthony				2.95	
Atchison	88	34	66.6	0.72	
Baker	86	34	64.0	1.04	
Beloit				3.79	
Blue Rapids				2.12	
Burlington	91	29	67.2	4.52	
Chapman				4.91	
Cimarron	94	32	63.6	0.72	
Clay Center	85	30	64.3	2.82	
Colby	90	32	61.3	1.67	
Columbus	89	34	66.1	6.34	
Coolidge	94	37	63.1	1.61	
Cottonwood Falls	88	28	65.6	2.66	
Cunningham	94	34	64.4	0.70	
Dresden	93	33	62.6	1.21	
Eldorado	88	39	66.0	6.41	
Ellinwood	93	39	64.6	1.04	
Ellsworth	93	33	65.0	3.73	
Emporia	87	35	65.6	1.65	
Englewood	97	33	66.8	2.21	
Enterprise	85	33	64.6	3.23	
Eureka				4.82	
Fall River	91	30	67.1	3.80	
Farnsworth	92	34	63.0	1.22	
Forsha	94	34	64.6	1.60	
Fort Scott	91	31	67.0	2.20	
Frankfort	86	32	64.2	1.27	
Fredonia	91	30	66.4	6.54	
Garden City	94	36	64.6	1.92	
Garnett	93	32	68.8	2.67	
Gove[d]	91	36	61.6	0.83	
Grenola	90	30	65.8	2.64	
Harrison	87	30	63.0	1.64	
Hays	96	33	64.4	1.51	
Horton	86	35	64.5	1.00	
Hoxie	93	32	63.6	1.15	
Hugoton	94	36	65.6	1.22	
Hutchinson	93	34	65.4	1.06	
Independence	99	36	69.5	1.77	
Jetmore	95	36	64.8	3.11	
Jewell	87	30	63.0	4.73	
La Crosse	96	36	65.8	2.96	
Lakin	92	35	63.4	2.81	
Larned	92	27	63.0	2.94	
Lebanon	88	25	61.8	2.80	
Lebo	90	34	66.3	2.69	
Lindsborg				1.33	
Macksville	93	33	63.3	1.62	
McPherson	87	33	64.9	1.64	
Manhattan *b*	91	31	66.5	2.00	
Manhattan *c*	88	30	64.9	1.96	
Medicine Lodge	96	38	66.4	1.68	
Minneapolis	90	34	64.1	2.90	
Moran	90	34	66.6	4.52	
Mounthope				1.31	
Neosho Rapids				1.10	
Ness City				3.99	
Newton				2.41	
Norton	92	30	63.6	0.65	
Norwich	92	38	66.1	2.37	
Oberlin				0.70	
Olathe	87	32	64.5	0.98	
Osage City	90	32	65.4	1.73	
Oswego	87	32	65.6	6.65	
Ottawa	90	29	65.9	2.18	
Pittsburg	89[g]	47[g]	70.4[g]	4.98	
Plainville	90[f]	35[f]	63.4[f]	2.22	
Pleasanton	87	32	66.3	1.05	
Pratt	90	37	66.8	1.12	
Republic	87	31	63.3	4.01	
Rome	92	31	64.8	5.56	
Russell	97	35	63.8	1.29	
Salina	87	31	65.4	1.56	
Scott	93	33	62.6	2.25	
Sedan	94	33	66.8	2.85	
Toronto	96	28	67.3	9.95	
Ulysses				3.19	
Valley Falls	88	32	66.4	0.96	
Wakeeney	92	34	63.1	1.33	
Wakeeney (near)				1.22	
Wallace	90	33	60.6	0.99	
Walnut	88	33[f]	64.9[f]	7.33	
Wamego[d]	86	42	65.6	1.55	
Winfield	89	33	66.6	3.22	
Yates Center	92	27	67.3	9.99	
Kentucky.					
Alpha	87	34	66.0	1.30	
Anchorage	90	35	66.0	1.58	
Bardstown	92	33	67.2	2.24	
Beattyville	92	32	64.6	3.14	T.
Beaver Dam	92	34	66.2	1.88	
Berea	90	32	66.8	3.02	
Blandville	89	40	67.2	1.48	
Bowling Green	94	37	68.5	2.05	
Burnside	89	35	64.2	3.46	
Cadiz	92	35	67.8	2.49	
Calhoun	93	36	67.8	2.01	
Catlettsburg	91	32	65.1	5.10	
Earlington	92	33	66.7	1.49	
Edmonton	89	32	64.7	4.20	
Eubank	90	31	63.6	3.16	
Falmouth				1.02	
Farmers	91	31	63.8	2.77	
Frankfort	87	35	65.0	1.66	
Franklin	91	38	67.6	1.95	
Greensburg	91	33	64.8	5.04	
High Bridge	95	24	64.9	2.27	
Hopkinsville	92	35	66.6	2.40	
Irvington	90	35	66.8	2.22	
Jackson	92	35	66.2	4.47	
Leitchfield	88	35	64.7	3.01	
Loretto	91	33	67.2	3.72	
Lynnville	90	36	67.2	3.80	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kentucky—Cont'd.	°	°	°	*Ins.*	*Ins.*
Manchester	90	32	65.4	2.42	
Marion	91	35	68.0	0.69	
Maysville	95	30	65.2	1.70	
Middlesboro	91	31	65.2	2.92	
Mount Sterling	90	32	65.1	3.31	
Owensboro	90	38	67.0	1.18	
Owenton	92c	31c	66.2c	4.05	T.
Paducah	93	40	70.4	0.74	
Princeton	93d	35d	67.5d	1.16	
Richmond	91	33	66.5	4.63	
St. John	90	32	63.6	2.07	
Scott	90	33	64.6	2.07	T.
Shelby City	89	31	64.3	3.25	T.
Shelbyville	92	32	64.6	1.22	T.
Taylorsville	91	32	65.7	3.32	
West Liberty	90	32	63.4	2.73	
Williamsburg	88	35	64.8	2.67	
Williamstown	90	31	64.4	0.63	
Louisiana.					
Abbeville	96	46	75.8	1.45	
Alexandria	99	45	75.9	4.02	
Amite	93	42	72.6	0.60	
Baton Rouge	93	47	73.4	0.90	
Burnside	94	44	73.3	0.21	
Calhoun	97	41	72.0	2.83	
Cameron	91	54	76.0	T.	
Cheneyville	97	46	75.8	1.15	
Clinton	91	45	72.3	1.95	
Collinston	95	45	72.8	4.95	
Covington	93	42	73.0	5.86	
Donaldsonville	95	48	76.1	1.65	
Farmerville	93	45	73.2	2.92	
Franklin	95	48	75.9	3.39	
Georgetown	93	42	72.4	1.99	
Grand Coteau	94	45	75.0	1.85	
Hammond	91	46	72.8	3.01	
Houma	94	43	73.5	0.54	
Jennings	97	48	74.9	1.95	
Lafayette	95	44	74.4	0.82	
Lake Charles	97	49	74.4	3.60	
Lakeside	94	48	74.5	0.23	
Lawrence	94	53	73.6	2.04	
Libertyhill	96	40	72.8	2.80	
Logansport				2.31	
Mansfield	98	44	72.0	2.96	
Melville	74	48	73.6	0.70	
Minden				1.75	
Monroe	98	47	74.0	1.88	
Morgan City				1.42	
New Iberia	91	52	74.6	2.22	
Opelousas	96	44	75.0	1.03	
Oxford				2.80	
Plain Dealing	94	41	72.8	2.09	
Rayne	96	46	75.2	0.38	
Reserve	98	48	75.4	1.02	
Robeline	94	40	72.6	3.70	
Ruston	100	45	74.0	4.15	
St. Francisville	95	41	73.2	3.50	
Schriever	96	41	74.0	2.88	
Simmesport				0.54	
Southern University				3.25	
Sugar Experiment Station	94	48	74.8	0.63	
Sugartown	92	42	73.8	3.01	
Maine.					
Bar Harbor	75	31	50.4	4.78	
Cornish	85	32	53.3	5.14	T.
Danforth				2.40	
Debsconeag	82	28	49.8	3.53	
Fairfield	86	31	53.0	3.55	
Farmington	86	27	52.4	3.67	
Fort Fairfield	80	21	48.0	2.68	
Gardiner	81	30	51.1	4.52	
Grant Farm				2.54	
Greenville	85	26	48.0	4.72	
Houlton	81	26	49.8	2.60	
Lewiston	84	33	52.6	4.21	
Madison	82	30	51.6	5.12	
Mayfield	79	29	49.6	3.90	
Millinocket	84	23	50.8	3.57	
North Bridgton	85	30	52.8	4.66	
Oquossoc	71	25	48.2	5.67	
Orono	83	28	51.4	5.44	
Patten				1.30	
Rumford Falls	84	30	52.1	4.22	
The Forks				3.13	
Thomaston	76d	30d	50.6d	5.82	
Vanburen	81	23	48.5	1.90	
Winslow	85	28	52.0	4.64	
Maryland.					
Annapolis	95	36	66.1	1.75	
Bachmans Valley	88	29	62.4	2.32	
Cambridge	95	37	65.8	4.65	
Cheltenham	91	29	63.4	2.92	
Chestertown	8s	36	63.1	2.93	
Chewsville	90	29	60.8	3.81	T.
Clearspring	92	35	62.6	2.79	T.
Coleman	92	39	64.8	4.38	
Collegepark	92	27	63.3	1.73	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Maryland—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cumberland				1.65	
Darlington	95	31	63.0	2.78	
Easton	90	40	63.8	3.15	
Fallston	91	33	62.2	3.59	
Frederick	93	33	64.6	2.45	
Frostburg				2.80	T.
Grantsville	79	29	57.0	1.99	1.5
Great Falls	95	28	65.2	2.37	
Greenspring Furnace	92	32	64.2	4.03	
Harney				1.89	
Hughesville		29	64.0	1.43	
Jewell	87e	37	62.0e	1.82	
Johns Hopkins Hospital				2.74	
Keedysville	95	29	64.6	2.42	
Lake Montebello	94	35	64.1	2.60	
Laurel	96	27	64.6	2.72	
McDonogh	88	31	62.2	3.64	
Mount St. Marys College	93	32	64.4	3.08	
New Market	91	33	64.2	2.30	
Oakland	83	24	56.6	1.97	
Pocomoke City	91	35	65.5	1.06	
Porto Bello	92	33	64.8	2.79	
Prince Fredericktown	93	34	65.2	1.91	
Princess Anne	91	31	62.8	3.63	
Salisbury	94	29	64.4	1.97	
Solomons	91	40	64.8	1.89	
Sudlersville	95c	36c	66.1c	2.19	
Takoma Park	92	35	64.6	2.01	
Taneytown	90	27	62.3	2.05	
Van Bibber	91	35	63.4	4.43	
Westernport	93	29	63.4		
Woodstock	92	32	65.4	3.58	
Massachusetts.					
Amherst	90	32	56.9	4.95	
Bedford	85	33	56.7	4.51	
Bluehill (summit)	89	34	56.4	5.30	
Chestnuthill	91	34	58.5	5.43	
Concord	89	30	55.6	5.07	
East Templeton ◆1	86	38	55.2	4.93	
Fallriver	84	39	57.1	3.89	
Fitchburg	90	33	57.6	6.78	
Framingham	89	31	57.6	5.25	
Groton	85	31	56.8	6.09	
Hyannis				4.47	
Jefferson				7.18	
Lawrence	90	33	56.6	4.79	
Leominster				6.38	
Lowell	90	34	58.6	6.00	
Ludlow Center				5.22	
Middleboro	87	30	56.6	4.31	
Monson	88	31	56.1	5.14	
New Bedford	86	38	57.6	3.51	
Plymouth	83	37	56.0	5.32	
Princeton				6.31	
Provincetown	80	38	56.0	4.46	
Salem				5.01	
Somerset ◆1	94	36	59.1	3.93	
Sterling				6.27	
Taunton	87	31	56.8	4.34	
Webster				6.27	
Westboro	90	31	58.8	6.57	
Weston	88	31	56.0	4.63	
Williamstown	86	32	55.4	5.40	T.
Winchendon				5.24	
Worcester	90	35	58.6	5.44	
Michigan.					
Adrian	89	28	59.9	4.75	
Agricultural College	85	30	56.6	3.05	T.
Allegan				2.50	
Alma	86	24	56.3	3.67	T.
Ann Arbor	86	29	58.2	4.87	
Arbela	85	27	57.6	3.21	
Baldwin				1.30	1.0
Ball Mountain	86	28	56.0	4.04	T.
Baraga				2.25	T.
Battlecreek	89	36	62.3	4.07	T.
Bay City	87	28	58.1	3.55	T.
Benzonia	82	26	52.7	2.91	T.
Berlin	86	27	54.3	2.90	0.5
Big Rapids	85	24	55.4	2.44	3.5
Birmingham	85	31	57.7	2.80	
Bloomingdale	90	29	59.3	2.30	T.
Calumet	80	27	48.3	3.00	T.
Carsonville	84	27	55.0	1.80	0.9
Cassopolis	88	32	60.2	4.29	
Charlevoix	86	28	53.0	0.77	
Charlotte	89	29	58.4	2.03	
Chatham	84	18	46.5	1.63	T.
Cheboygan	84	24	51.4	1.13	T.
Clinton	88	29	58.6	4.60	T.
Coldwater	87	27	61.0	6.63	
Concord	86	27	58.2	5.06	T.
Deer Park	83	22	46.2	2.72	T.
Detour	78	28	47.0	1.20	T.
Dundee	86	28	59.4	4.36	T.
Eagle Harbor	77	28	44.0	2.56	
East Tawas	88	27	52.4	2.22	
Eloise	88	30	58.4	1.35	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Fenville	86	30	57.6	4.28	
Flint	86	29	57.0	3.50	
Grand Marais	75	27	43.8	2.51	T.
Grape	88	28	58.2	3.84	T.
Grasslake	86	28	55.8	5.32	1.5
Grayling	87	23	53.5	2.10	3.0
Hagar	89	28	56.6	4.01	
Harbor Beach	83	30	51.1	2.25	
Harrisville	87	27	50.0	4.10	
Hastings	88	25	58.1	4.01	T.
Hayes	85	28	53.4	3.82	
Highland				2.93	T.
Hillsdale	86	28c	58.6c	4.50	T.
Holland	89	28	60.2	3.79	
Howell	84	28	57.2	2.53	T.
Humboldt	87	18	46.0	3.60	
Iron Mountain	88	25	50.6	2.22	T.
Iron River	88	20	50.2	4.40	T.
Ironwood	80	26	50.3	2.58	0.7
Ishpeming	87	22	44.4	2.74	
Isle Royal	60	30	41.4	6.74	T.
Ivan	88	22	54.5	3.25	2.0
Jackson	90	29	60.4	4.14	
Jeddo	83	28	53.9	1.99	
Kalamazoo	85	30	59.0	3.66	
Lansing	85	29	58.0	3.33	T.
Ludington				1.45	1.0
Mackinac Island	75	25	46.7	1.89	T.
Mackinaw City	65	30	47.4	1.37	
Mancelona	87	20c	51.9c		2.0
Maple Ridge	86	22	48.0	1.56	
Menominee	85	29	50.5	1.95	T.
Mio	85	23	53.2	3.43	2.5
Montague	84	28	54.4	1.70	1.0
Mount Clemens	89	28	55.6	3.04	T.
Muskegon	81	30	55.8	1.67	T.
Newberry	85			2.50	T.
Old Mission	83	28	52.4	2.34	2.0
Olivet	85	30	57.6	4.30	T.
Omer	86	26	54.3	1.37	T.
Ovid	90	25	57.2	2.52	T.
Owosso	86c	29c	57.8c	1.94	
Petoskey	85	28	53.8	0.75	1.0
Plymouth	89	25	57.8	1.85	
Port Austin	85	31	51.6		
Power	89	28	51.0		
Reed City	89	24	55.8	2.43	2.0
Roscommon	86j	20j	54.2j		2.0
Saginaw (W. S.)	87	28	57.0	2.66	T.
St. James	78	29	49.0	0.90	T.
St. Joseph	85	38	57.2	3.40	
Slocum	84	23	55.8	2.39	
Somerset	84	28	56.8	4.54	
South Haven	80	28	53.0	3.86	
Staunton	85	21	56.4	3.29	3.0
Thomaston	84	19	49.8		1.0
Thornville	86	30	58.3	3.60	T.
Traverse City	87	29	52.8	1.42	T.
Vassar	90d	28c	55.0c	3.35	
Wasepi	86	30	59.4	3.79	
Webberville	87	28	57.5	3.83	T.
West Branch	85f	21f	52.7f	1.32	2.0
Wetmore	87	12	45.6	0.85	
Whitefish Point	70	26	42.6	2.15	T.
Woodlawn	86	18	50.4	3.10	10.0
Ypsilanti	87	26	57.0	4.39	T.
Minnesota.					
Albert Lea	88	30	58.0	5.22	
Alexandria	90	23	53.5	4.32	
Amboy				4.36	
Angus	81	18	50.8	4.14	
Ashby	82	25	58.8	5.46	
Bagley	87	19	50.2	2.17	1.0
Bemidji	91	20	51.0	3.97	
Bird Island	87	26	56.6	5.64	T.
Caledonia	83	29	57.2	8.86	1.0
Campbell	90	22	53.4	3.44	0.2
Cass Lake				4.89	
Collegeville	84	26	53.8	4.38	0.8
Crookston	89	24	51.0	4.16	T.
Detroit	88	18	50.0	7.30	2.0
Fairmont	85	31	57.7	3.63	T
Faribault	87	26	56.2	5.98	
Farmington	83	27	55.6	7.71	2.0
Fergus Falls	87	27	54.7	3.66	1.5
Floodwood	80	20	51.2	5.39	
Fort Ripley				2.29	
Glencoe				8.51	
Grand Meadow	83	27	55.6	6.31	
Hallock	88	14	50.5	2.74	
Halstead	93	23	50.8	6.46	T.
Hinckley	80	23	52.4	4.65	0.3
Hovland	69	24	43.4	2.90	
Leech	80	18	50.7	6.00	1.0
Little Falls	85	25	52.4		
Long Prairie	85	20	53.6	3.57	T.
Luverne	89	27	57.4	2.53	T.
Lynd	91	20	55.4	5.84	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Minnesota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Mankato				5.39	
Mapleplain	85	26	56.6	9.21	0.4
Milaca	84	23	51.9	5.31	
Milan	90	23	55.6	7.73	T.
Montevideo	91	25	57.2	5.70	T.
Mora	81	20	52.0	4.65	0.5
Morris	88	26	55.0	6.00	T.
Mount Iron	79	19	49.1	5.83	T.
New London	86	26	53.4	6.86	T.
New Richland	85	27	58.6	3.51	T.
New Ulm	92	26	59.5	5.20	T.
Park Rapids	89	22	50.3	5.36	1.5
Pine River	82	19	48.8	4.72	.....
Pipestone	88	26	55.8	6.50	
Pokegama Falls	81	19	49.5	4.63	T.
Redwing	81	28	57.2	7.41	
Reeds				7.70	
St. Charles	80	28	56.4	5.93	
St. Cloud	87	24	55.0	6.50	.....
St. Peter	89	25	55.4	5.25	
Sandy Lake Dam	79	25	51.8	3.16	
Shakopee	85	27	57.3	8.80	
Stillwater				9.82	
Tonka				9.82	
Two Harbors	74	27	45.6	3.86	
Wabasha	87	30	59.6	7.30	
Wadena	84	21	51.8	4.13	T.
Willow River	81	17	48.6	4.33	
Windom	92	26	58.2	4.58	T.
Winnebago	92	26	58.5	3.33	T.
Winnibigoshish	81	26	51.0	3.59	T.
Winona	81	32	56.4	6.17	T.
Worthington	86	26	56.0	1.04	T.
Zumbrota	83	28	57.0	4.92	
Mississippi.					
Aberdeen	95	39	69.0	6.10	
Agricultural College				4.33	
Austin	93	40	69.8	3.77	
Batesville	95	40	69.8	6.89	
Bay St. Louis	91	47	73.6	0.45	
Biloxi	91	49	74.4	2.20	
Booneville	90	38	68.0	4.06	
Brookhaven	94	43	72.3	2.95	
Canton	91	41	70.3	5.44	
Columbia				4.38	
Columbus	93	40	69.8	5.42	
Corinth	89	39	67.6	2.26	
Crystal Springs	92	42	70.1	5.01	
Duck Hill	94	37	69.6	7.98	
Edwards	91	41	71.6	3.31	
Enterprise				9.14	
Fayette	89	41	70.8	4.00	
Fayette (near)				4.17	
Greenville *b*	92	42	70.6	6.49	
Greenwood	90	42	69.6	7.40	
Hattiesburg	97	41	71.0	4.09	
Hazlehurst	90	44	70.5	4.00	
Hernando	92	42	68.0	4.50	
Holly Springs	92	42	69.2	2.22	
Indianola	92	41	68.5	5.75	
Jackson	90	41	70.4	6.70	
Kosciusko	91	38	69.0	5.77	
Lake	92	38	70.0	7.37	
Lake Como	92	38	70.4	7.68	
Laurel	92[e]	40[e]	71.6[e]	4.55	
Leakesville	94	42	71.6	3.28	
Louisville	90	37	68.5	5.66	
McNeill	94	45	71.9	3.02	
Macon	93	39	69.8	4.50	
Magnolia	96	43	73.0	2.23	
Merrill				3.44	
Natchez	94	44	73.2	2.08	
Nitta Yuma	94	43	72.2	4.91	
Okolona	93	39	68.7	7.99	
Patmos				5.00	
Pearlington	98	41	71.8	1.24	
Pecan	93	48	72.7	3.19	
Pittsboro	94	37	69.0	7.59	
Pontotoc	91	40	68.5	3.61	
Port Gibson	94	39	71.4	2.22	
Porterville	92	38	69.0	5.42	
Quitman	90	40	69.8	10.34	
Ripley	92	34	68.2	2.75	
Shelby	95	41	71.2	4.12	
Shoccoe	93	40	71.3	5.55	
Shubuta				8.77	
Stonington				3.30	
Suffolk	94	41	72.8	2.88	
Swan Lake	94	41	69.5	6.72	
Tchula	93	41	70.8	3.25	
Tupelo	94	38	68.6	3.74	
University	92	40	69.0	5.67	
Utica	91	40	70.6	2.25	
Walnutgrove	87[d]	40[d]	70.8[d]	7.37	
Watervalley	93	38	68.7	9.75	
Waynesboro	90	40	70.2	7.77	
Woodville	94	43	73.1	2.44	
Yazoo City	92	43	71.0	8.10	
Missouri.					
Albany				1.10	
Appleton City	90	32	66.2	2.97	
Arlington				2.14	
Arthur	89	30	66.4	4.38	
Avalon	89	32	65.2	2.43	
Bagnell				4.30	
Belle	91	31	66.0	2.87	
Bethany	87	27	63.6	1.13	
Birchtree	86[c]	35[c]	65.2[c]	2.40	
Bolivar	92[d]	33[d]	65.2[d]	3.13	
Boonville				1.26	
Brunswick	89	33	65.8	1.80	
Cape Girardeau				0.31	
Caruthersville	98	39	69.2	2.29	
Conception	87	34	64.2	1.23	
Darksville	89	32	65.2	1.85	
Dean	90	30	67.2	7.85	
De Soto	92	33	66.6	2.92	
Doniphan	89	35	66.4	3.59	
Eldorado Springs	91	33	67.3	3.80	
Fairport				1.01	
Fayette	88	30	64.2	2.50	
Fulton	90	30	66.2	2.34	
Gads Hill	90	29	65.1	1.89	
Gallatin *a*	94	38	66.8	1.12	
Gano	90	34	66.5	3.33	
Glasgow				2.78	
Goodland	87	30	63.8	3.34	
Gorin				1.61	
Grant City	86	34	64.4	0.92	
Harrisonville	90	29	66.4	1.30	
Hazlehurst				1.84	
Hermann				2.54	
Houston	89	28	65.2	2.02	
Ironton	92	30	65.7	1.81	
Jackson	93	33	68.4	1.20	
Jefferson City	91	33	65.4	2.90	
Joplin	90	34	68.4	5.91	
Kidder	88	33	64.0	1.37	
Koshkonong	89	37	66.5	3.07	
Lamar	87	34	66.3	3.05	
Lamonte				1.19	
Lebanon	90	32	66.2	5.12	
Lexington	89	35	67.3	1.31	
Liberty	88	32	64.6	0.76	
Lockwood	87	33	66.0	4.32	
Louisiana	90	28	65.0	3.33	
Macon	92	32	66.8	3.05	
Marblehill	92	34	67.3	1.45	
Marshall	89	29	65.4	1.00	
Maryville	88	35	63.4	0.89	
Mexico	91	30	65.0	4.43	
Monroe	91	31	64.1	2.14	
Mountain Grove	86	31	64.4	2.51	
Neosho	88	30	67.0	5.65	
New Haven	92	35	67.9	2.30	
New Madrid				2.81	
New Palestine	90	33	68.1	1.59	
Oakfield	90	36	67.2	2.27	
Olden	89	29	66.5	2.58	
Oregon	86	35	65.0	1.23	
Osceola				2.15	
Princeton	93	32	66.4	1.42	
Rockport				1.05	
Rolla				2.83	
St. Charles	89	35	67.2	3.56	
St. Joseph				0.84	
Sarcoxie				3.05	
Sedalia	88	33	67.0	1.28	
Sikeston	90	37	67.6	1.62	
Steffenville	90	32	65.0	1.71	
Sublett	88	30	63.6	1.94	
Trenton	87	35	65.4	1.40	
Unionville	90	33	63.4	3.59	
Versailles	93	30	67.2	1.20	
Warrensburg	91	35	68.0	1.33	
Warrenton	90	33	65.2	4.99	
Warsaw	93	28	67.2	2.42	
Wheatland				3.41	
Willowsprings	89	28	63.6	2.46	
Windsor	90	30	66.4	0.95	
Montana.					
Absarokee				5.14	3.0
Adell	80	18	44.6	3.18	2.6
Anaconda	83	17	47.5	3.37	
Augusta	85	19	46.6	6.43	T.
Babb				4.99	.....
Billings	96	30	56.8	3.04	
Bozeman	80	24	47.7	2.34	
Butte	81	23	46.6	3.64	10.5
Canyon Ferry	89	29	51.9	3.31	1.0
Cascade	88	28	51.0	5.79	0.1
Chester	88	21	51.2	4.00	
Chinook	94	25	52.6	4.39	
Choteau	90	22	48.6	4.47	
Clear Creek	87	27	49.8	5.60	
Columbia Falls	83	27	49.9	3.68	2.0
Copper				2.54	T.
Montana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Crow Agency	90	25	55.4	3.35	
Culbertson	90	20	50.6	3.50	
Dayton	81	25	50.3	4.08	
Decker	90	29	53.6	3.00	
Dillon	81	22	50.9	4.11	2.0
Ekalaka	88	22	50.2	3.63	
Ericson				3.66	
Evans	85	26	49.4	7.66	0.2
Fallon	91	9	51.0	2.72	T.
Forsyth	92	22	54.4	4.69	
Fort Benton	91	28	52.5	4.02	
Fort Harrison	82	27	49.3	.....	
Glasgow	90	20	50.7	5.69	
Glendive	91	29	54.2	5.18	
Gold Butte				7.81	3.5
Graham	88	24	52.8	4.28	T.
Grave Creek Cabin	92	10	51.2	2.82	
Grayling	71	18	43.2	2.56	T.
Greatfalls	87	30	50.1	5.03	T.
Hamilton	83[e]	24	52.9	2.73	
Highwood				5.28	3.0
Homepark				3.14	
Huntley	90	28	54.1	2.50	T.
Jordan	93	20	52.8	4.64	T.
Lakeview				4.80	6.0
Lame Deer	88	23	52.6	2.18	
Lewistown	88	24	49.4	3.78	1.0
Livingston	85	24	50.3	2.08	T.
Lodge Grass	90	22	53.6	3.26	
Malta	90[e]	21[e]	53.4[e]	4.75	
Marion	82	18	48.0	.....	
Marysville	76	22	44.2	4.81	4.0
Mullets Ranch				5.45	
Missoula	85	28	54.2	2.91	
Nye				6.22	
Ovando	85	21	48.0	3.10	.....
Philipsburg	80	21	47.1	2.65	1.5
Plains	84	26	51.6	4.52	
Poplar	90	19	50.6	4.94	
Raymond				5.07	2.7
Redlodge	78	20	46.3	4.72	
Renovo	88	21	50.4	2.45	T.
Ridgelawn	90	18	51.5	4.53	
St. Pauls	93	22	51.1	9.27	T.
St. Peter	81	25	46.5	6.47	8.5
Saltese				3.30	
Springbrook	89	22	52.0	3.90	1.0
Steele	88[e]	28[f]	49.2[f]	3.81	
Tokna	91	19	52.6	5.25	T.
Toston	88	24	53.6	2.04	
Townsend				2.74	
Troy	86	25	52.8	1.88	
Twin Bridges	92	25	53.3	2.40	
Utica	85	23	48.2	2.61	2.0
Virginia City	78	21	47.2	5.31	7.5
Warrick	84	26	47.6	3.17	T.
Whitlash	90[d]	21[d]	48.4[d]	4.86	
Wolf Creek	85	22	48.4	3.37	0.7
Wolf Point				7.07	
Wolsey	79	15	43.6	2.63	3.0
Yale	87	21	48.7	5.92	2.0
Nebraska					
Agate	85	20	52.0	2.76	
Ainsworth	92	24	60.0	4.15	0.2
Albion	87	25	60.0	4.29	
Alliance	89	23	56.1	2.81	T.
Alma	94	32	63.6	0.88	
Anoka				4.16	
Arapaho				1.12	
Arcadia				0.51	
Ashland	85	32	63.4	1.90	
Ashton				0.87	
Auburn	87	31	62.2	1.83	
Aurora	87	28	61.2	2.10	
Beatrice	85	32	63.6	2.51	
Beaver	95	33	63.5	0.71	
Bellevue	85	32	62.8	2.79	
Blair	89	33	62.7	7.04	
Bloomfield	91	32	59.7	2.36	
Bluehill				1.22	
Bradshaw				3.95	
Bridgeport	88	23	55.4	2.87	
Broken Bow	92	26	60.1	2.23	
Burchard				3.25	
Burge				4.40	
Callaway	91	26	60.4	1.06	
Central City				4.88	
Chester				2.85	
Clearwater	94	26	61.2	3.14	
Cody				2.34	
Columbus	87	30	61.0	3.94	
Crawford				5.37	
Crete	84	32	63.5	1.86	
Culbertson	96	32	62.6	1.14	
David City	85	31	61.4	3.64	
Dawson	89	34	65.7	1.51	
Dubois				1.46	
Duff				4.05	T.

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Edgar	.....	.....	.....	2.95	
Ellis	.....	.....	.....	2.80	
Ericson	.....	.....	.....	3.50	
Ewing	.....	.....	.....	1.78	
Fairbury	85	31	63.4	3.12	
Fairmont	87	29	61.0	2.65	
Fort Robinson	86	23	53.6	3.94	
Fremont	87	32	62.5	4.63	
Fullerton	.....	.....	.....	2.72	
Geneva	87	30	62.8	2.16	
Genoa (near)	88	30	62.2	1.99	
Gering	87	27	56.4	3.95	
Gosper	.....	.....	.....	0.90	
Gothenburg	92	26	62.0	1.29	
Grand Island	91	36	62.6	4.02	
Grant	92	23	60.4	3.02	
Greely	.....	.....	.....	0.45	
Guide Rock	.....	.....	.....	1.74	
Haigler	.....	.....	.....	1.50	
Halsey	93	25	60.4	2.49	
Hartington	95	28	60.4	1.16	
Harvard	86	29	60.4	2.56	
Hastings[*1]	84	41	63.7	2.20	
Hayes Center	90	30	60.0	3.15	
Hay Springs	89	22	54.8	3.02	T.
Hebron	85	31	62.4	3.40	
Hendley	.....	.....	.....	0.96	
Hickman	.....	.....	.....	3.00	
Holbrook	94	31	61.8	1.17	
Holdrege	92	30	62.8	1.40	
Hooper[*1]	90	38	62.0	6.08	
Imperial	88	23	57.4	2.43	
Kearney	89	30	62.3	3.86	
Kennedy	.....	.....	.....	3.32	
Kimball	95	25	55.1	3.86	T.
Kirkwood	92	24	58.8	2.44	
Leavitt	88	30	60.8	5.06	
Lexington	92	29	60.9	0.97	
Loup	92	25	61.6	1.60	
Lynch	97	26	62.4	2.28	
McCook	.....	.....	.....	2.15	
McCool	.....	.....	.....	1.65	
Madison	86	30	60.6	4.51	
Marquette	.....	.....	.....	2.58	
Mason	.....	.....	.....	0.33	
Merriman	.....	.....	.....	1.66	
Minden	91	28	61.8	0.78	
Monroe	.....	.....	.....	2.82	
Nebraska City	84	32	63.8	1.66	
Norfolk	90	30	61.1	5.95	
North Loup	92	27	62.0	1.33	
Oakdale	94	28	60.6	2.16	
Oakland	87	28	61.0	4.73	
Odell	.....	.....	.....	2.26	
Ord	.....	.....	.....	1.64	
Palmer	.....	.....	.....	1.80	
Palmyra[*1]	86	36	64.0	0.85	
Pawnee City	85	30	63.2	2.65	
Plattsmouth	.....	.....	.....	1.54	
Plymouth	.....	.....	.....	2.90	
Purdum	91	24	59.0	2.77	
Ravenna	92	28	61.8	2.27	
Rulo	.....	.....	.....	0.72	
St. Libory	.....	.....	.....	1.50	
St. Paul	91	30	62.6	5.01	
Santee	95	28	63.0	3.53	
Schuyler	.....	.....	.....	4.90	
Seneca	.....	.....	.....	4.75	
Seward	90	30	62.0	0.90	
Smithfield	.....	.....	.....	0.92	
Springview	91	25	58.2	2.21	
Stanton	89	28	62.2	3.31	
Strang	.....	.....	.....	2.54	
Stratton	.....	.....	.....	1.90	
Strausburg	.....	.....	.....	0.90	
Superior	89	33	64.6	3.30	
Syracuse	.....	.....	.....	0.82	
Tablerock	.....	.....	.....	2.38	
Tecumseh	88	25	62.8	1.96	
Tekamah	89	32	62.3	5.08	
Turlington	88	31	63.0	1.53	
University Farm	85	33	63.2	1.71	
Wahoo	.....	.....	.....	1.05	
Wakefield	89	27	60.4	4.23	
Watertown	.....	.....	.....	1.04	
Wauneta	.....	.....	.....	2.44	
Weeping Water	.....	.....	.....	1.75	
Westpoint	87	29	61.8	2.09	
Whitman	.....	.....	.....	4.15	
Wilber	.....	.....	.....	2.58	
Wilsonville	.....	.....	.....	1.75	
Wisner	.....	.....	.....	4.34	
Wymore	.....	.....	.....	1.91	
York	85	30	62.0	1.61	
Nevada.					
Amos	88	31	59.2	1.96	.....
Austin	78	25	49.8	2.50	7.0
Battle Mountain	92	26	57.4	.....	
Carlin[*1]	85	30	54.2	1.25	.....
Carson City	81	26	51.2	1.08	0.2
Columbia	81	29	54.2	0.76	
Dyer	82	22	54.5	0.22	
Elko[*1]	.....	.....	.....	1.42	.....
Eureka	76	23	49.8	2.59	T.
Fallon	84	31	56.6	0.72	
Geyser	78	25	48.4	1.82	T.
Halleck[*5]	84	28	53.6	1.60	T.
Hamilton	72	29	44.5	2.62	6.0
Hazen	85	28	57.0	0.70	
Humboldt	85	28	54.6	0.75	
Lewers Ranch	84	25	51.6	2.75	
Logan	98	41	71.0	T.	
Lovelocks	85	30	55.6	0.15	
Martins	92	26	56.0	0.30	
Mill City[*1]	.....	.....	.....	1.10	
Morey	76	20	49.0	2.01	0.6
Palisade	87	24	53.8	1.83	.....
Palmetto	76	19	47.5	3.44	.....
Paradise Valley	.....	.....	.....	1.87	6.0
Pioche	91	17	51.8	0.89	T.
Potts	80	17	47.8	0.45	T.
San Jacinto	82	20	52.3	1.45	
Squaw Valley	88	14	50.0	1.46	T.
Tecoma	83	28	57.1	1.97	
Wabuska	81	27	53.8	0.90	
Wadsworth	89	29	56.4	.....	
Wells[*1]	.....	.....	.....	1.56	.....
Wood	.....	.....	.....	2.96	
New Hampshire.					
Alstead	85	30	54.5	6.15	
Bartlett	.....	.....	.....	5.13	
Bethlehem	84	25	50.8	5.05	
Bretton Woods	.....	.....	.....	5.50	
Brookline	90	28	57.6	6.40	
Durham	86	30	53.6	6.20	
Franklin Falls	91	27	54.7	5.73	T.
Grafton	87	24	52.0	6.76	1.0
Groveton	.....	.....	.....	4.64	T.
Hanover	90	27	54.0	6.95	
Keene	91	27	55.6	5.16	T.
Nashua	91	31	57.8	7.22	
Newton	86	28	54.4	6.59	
Plymouth	96	28	54.2	5.27	
New Jersey.					
Asbury Park	89	37	59.3	5.11	
Bayonne	90	38	61.5	4.99	
Belvidere	94	31	62.0	3.86	
Bergen Point	88	34	61.0	5.24	
Beverly	93	35	63.4	3.56	
Bridgeton	93	36	64.9	3.15	
Browns Mills	94	30	61.9	4.39	
Canton	.....	.....	.....	6.28	
Cape May C. H.	89	39	62.6	3.52	
Charlotteburg	90	30	58.4	5.79	
Clayton	91	35	62.6	2.37	
College Farm	90	32	61.6	4.75	
Dover	90	31	58.6	4.55	
Elizabeth	91	35	64.1	4.87	
Englewood	89	34	60.4	4.74	
Flemington	94	34	62.2	3.95	
Friesburg	93	34	63.2	4.12	
Hightstown	90	31	60.6	3.90	
Imlaystown	.....	.....	.....	4.37	
Indian Mills	94	35	63.6	3.35	
Jersey City	90	38	62.7	4.48	T.
Lakewood	91	36	62.4	3.55	
Lambertville	92	35	62.8	3.78	
Layton	89	24	57.7	4.35	
Moorestown	90	35	62.1	2.66	
Newark	91	39	62.4	4.77	
Newton	91	30	59.6	5.97	
Oceanic	86	37	61.0	2.96	
Paterson	94	34	63.3	3.73	T.
Phillipsburg	93	35	62.2	4.43	
Plainfield	90	30	61.0	5.51	
Pleasantville	.....	.....	.....	3.29	
Rancocas	.....	.....	.....	3.41	T.
Rivervale	90	25	58.9	4.29	
Sandy Hook	88	41	60.4	3.83	
Somerville	93	28	61.9	5.01	
South Orange	88	36	60.4	4.22	
Sussex	92	29	60.0	5.43	
Trenton	88	36	62.6	5.08	T.
Tuckerton	92	35	61.4	2.86	
Vineland	93	34	62.9	3.55	
Woodbine	92	32[4]	62.6	3.51	
New Mexico.					
Alamagordo	93	42	69.0	0.27	
Albert	90	39	63.4	0.41	
Albuquerque	86	38	64.4	0.05	
Alto	.....	.....	.....	1.16	
Artesia	99	40	68.5	0.23	
Bellranch	92	35	63.7	0.46	
Bloomfield	93	32	61.6	0.69	
Cambray	.....	.....	.....	0.00	
Carlsbad	101	43	72.8	0.49	
Chama	75	23	50.2	1.50	10.0
Cimarron	82	24	56.2	0.34	
Cliff	92	30	62.2	0.05	
Cloudcroft	75	25	49.2	1.17	
Datil	84	19	52.2	0.08	
Deming	93	32	63.6	0.05	
Dorsey	88	28	58.0	0.05	
Eagle Rock Ranch	80	31	54.8	0.79	T.
Elk	88	39	62.0	1.32	
Engle	85	34	61.0	0.20	
Espanola	86[4]	27[4]	56.4[4]	0.75	
Estancia	85	22	54.6	0.03	
Fairviews	87	27	56.2	.....	
Fort Bayard	86	35	61.7	0.08	
Fort Stanton	87	28	58.5	0.02	
Fort Union	80	21	52.8	0.58	
Fort Wingate	80	32	56.4	0.60	
Fruitland	86	34	61.0	0.06	
Glen	97	38	67.0	0.53	
Gran Quivira	.....	.....	.....	0.05	
Hillsboro	88	42	65.5	0.47	
Hope	.....	.....	.....	0.17	
Laguna	93	22	59.8	0.37	
Lagunita	92	34	61.2	0.72	
Lake Valley	.....	.....	.....	0.11	
Las Vegas	86	23	58.0	1.08	
Logan	90	35	64.4	0.90	
Lordsburg	93	37	66.6	T.	
Los Alamos	.....	.....	.....	1.87	
Los Lunas	88	33	62.6	0.45	
Luna	81	18	52.5	0.45	
Magdalena	91	31	61.8	0.06	
Manuelito	.....	.....	.....	0.25	
Mesilla Park	95	35	66.3	0.40	
Mineral Hill	.....	.....	.....	1.05	T.
Monument	100	34	66.6	0.11	
Nara Visa	89	34	64.6	1.02	
Orange	100	40	67.8	0.03	
Palma	.....	.....	.....	0.00	
Portales	93	38	66.4	0.74	
Redrock	.....	.....	.....	0.11	
Rincon	93	33	66.2	0.62	
Rociada	72	24	50.2	0.97	
Rosedale	81	33	59.3	0.45	
San Marcial	101	35	68.8	.....	
San Rafael	90	29	57.4	0.50	
Socorro	97	38	65.8	0.23	
Strauss	.....	.....	.....	T.	
Taos	84	21	54.2	0.82	2.0
Tres Piedras	79	20	51.2	0.40	2.0
Tucumcari	89	39	65.9	1.00	
Tularosa Creek Cabin	88	22	55.6	0.02	
Valley	.....	.....	.....	0.10	
Vermejo	76	26	51.8	0.63	2.0
Weed	.....	.....	.....	1.59	
Whiteoaks	.....	.....	.....	0.21	
New York.					
Adams	.....	.....	.....	3.27	0.2
Addison	91	24	56.8	4.06	T.
Akron	.....	.....	.....	2.56	
Amsterdam	87	30	56.7	6.28	
Angelica	85	23	54.0	3.70	T.
Appleton	86	30	54.4	1.75	
Athens	90	32	58.6	3.95	T.
Atlanta	85	24	55.4	5.63	
Atwater	.....	.....	.....	3.66	
Auburn	86	30	56.6	5.37	
Avon	86	29	56.0	3.03	
Ballston Lake	88	30	56.0	4.04	
Bedford	92	32	61.0	4.99	
Berlin	87	29	56.0	4.94	
Blue Mountain Lake	.....	.....	.....	7.52	1.5
Bolivar	86	22	54.2	3.98	T.
Bouckville	84	28	55.0	4.86	
Brockport	88	31	57.0	1.65	
Cape Vincent	76	33	51.8	2.15	
Carmel	86	35	58.0	4.50	
Carvers Falls	90	29	54.6	3.85	
Chatham	93	31	58.4	4.08	
Chazy	87	28	53.8	2.44	T.
Coeymans	93	28	59.8	4.60	
Cold Spring Harbor	88	31	59.6	3.45	
Cooperstown	84	30	54.5	7.35	
Cortland	91	31	58.0	5.73	
Cutchogue	86	33	57.8	5.10	
Dannemora	86	30	52.4	2.13	T.
Dekalb	84	29	53.9	1.36	
De Ruyter	86	24	54.3	4.64	T.
Easton	.....	.....	.....	9.18	
Elba	82	28	54.6	2.19	T.
Elmira	92	29	58.0	5.16	
Faust	85	23	51.0	1.58	
Fayetteville	89	31	58.1	3.43	
Fort Plain	89	32	59.2	4.79	
Franklinville	92	25	54.0	4.76	T.
Gabriels	88	23	50.9	0.89	T.
Gansevoort	.....	.....	.....	5.77	
Glens Falls	94	31	56.1	5.83	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Gloversville	87	29	55.7	5.31	
Greenfield	90	30	55.6	2.82	
Greenwich	89	29	56.1	6.13	
Griffin Corners	83	23	53.2	4.77	T.
Harkness	90	31	52.6	2.02	
Haskinville				4.17	T.
Hemlock	82	35	56.3	4.08	
Hunt	86	26	55.4	3.96	0.3
Indian Lake	92	29	52.9	4.88	
Ithaca	89	29	56.1	3.71	T.
Jamestown	87	31	57.3	2.98	T.
Jeffersonville	87	25	55.6	3.75	T.
Keene Valley	90	23	52.1	4.35	T.
Lake George	95	30	55.2	4.79	
Le Roy	85	29	56.4	2.27	T.
Liberty	83	27	54.6	4.41	T.
Littlefalls, City Res.	84	31	55.8	4.39	
Lockport	83	32	55.2	1.96	T
Lowville	85	25	53.3	4.23	
Lyndonville				1.01	
Lyons	89	33	57.7	3.09	
Middletown	88	34	59.4	5.02	T.
Mohonk Lake	87	32	56.4	4.83	
Moira	87	30	53.1	3.55	T.
Mount Hope	89	30	59.8	3.79	
Newark Valley				3.59	
New Lisbon	84	24	52.6	5.85	T.
North Lake	83	25	51.6	7.21	
Ogdensburg	82	33	55.6	1.95	
Oneonta	90	30	57.2	4.14	T.
Oriskany Falls	88	29	56.5	5.12	T.
Otto	85	31	58.2	2.44	
Oxford	85	29	56.0	5.66	T.
Oyster Bay	88	36	59.8	3.53	
Perry City	87	22	55.0	3.77	
Plattsburg	93	31	55.7	2.37	
Port Jervis	90	28	59.4	4.07	
Potsdam	86	30	54.8	2.11	
Richland				4.16	
Ridgeway	83	31	54.6	2.50	T.
Romulus	89	32	57.0	2.19	
Salisbury Mills				5.42	
Saranac	85	25	50.6	3.56	T.
Scarsdale	86	32	59.5	2.26	T.
Setauket	86	35	59.0	4.53	
Shortsville	86	29	55.6	4.11	
Skaneateles				5.01	
Southampton	85	36	56.6	7.95	
South Canisteo	88	24	54.5	3.29	T.
South Schroon	89	25	52.2	3.57	0.2
Spier Falls	91	31	56.8	5.55	
Taberg	88	27	56.2	3.52	
Ticonderoga	91	32	54.0	3.32	
Volusia	82	30	55.2	3.01	2.0
Wappinger Falls	92	37	59.7	6.11	
Warwick				5.96	
Watertown	80	31	54.4	4.38	
Waverly	92	25	57.2	4.04	T.
Wedgwood	87	28	55.0	5.04	T.
West Berne	89	27	55.6	3.62	
Westfield	84	32	56.0	2.98	
Windham	85	28	56.0	5.30	T.
Youngstown				1.82	
North Carolina.					
Battleboro				3.05	
Beaufort	85	45	69.8	1.19	
Brevard	87	28	62.3	3.60	
Brewers	91	28	65.6	1.82	
Bryson City				2.95	
Buck Springs	78	24	57.1	11.95	T.
Caroleen	94[e]	32	68.2[e]	1.87	
Chalybeate Springs	95			1.98	
Chapelhill	94	34	67.2	3.12	
Eagletown	93	36	67.2	2.98	
Edenton	93	38	68.5	3.25	
Fayetteville	94	39	69.1	2.24	
Goldsboro	94	38	68.6	4.55	
Graham				2.95	
Greensboro	95	33	67.0	2.62	
Greenville				3.30	
Henderson	91	37	67.3	2.95	
Hendersonville	87	29	62.0	3.11	
Horse Cove	83	32	62.0	4.09	
Hot Springs	90	33	67.6		
Kinston	98	37	70.0	3.41	
Lenoir	96	29	66.6	2.36	
Lexington	95	29	66.2	3.07	
Lincolnton	94	32	67.6		
Linville	78	26	54.9	2.76	
Louisburg	93	36	67.4	3.74	
Lumberton	98	37	70.0	2.08	
Manteo	92	43	67.1	1.78	
Marion	93	30	66.3	3.34	
Moncure	95	34	67.2	2.73	
Monroe	93	28	66.0	3.96	
Morganton	92	34	65.0	2.02	
Mountairy	92	28	64.0	2.01	
Mount Holly				2.06	
Murphy				2.08	
Nashville	98	34	68.2	2.13	
Newbern	95	39	69.6	3.14	
Patterson	88	30	61.5	3.34	
Pinehurst	94	37	69.0	2.77	
Pink Beds	82	23	55.8	7.39	
Pittsboro	96	33	67.0	1.24	
Randleman				2.37	
Reidsville	97	32	66.8	4.08	
Rockingham	97	40	71.0	2.30	
Salem	94	31	66.0	2.81	
Salisbury	94	30	67.6	2.70	
Sapphire	82	25	58.9	4.31	
Saxon	90	27	63.8	1.80	
Scotland Neck	94	37	68.4	2.48	
Selma	92[e]	37[e]	68.2[e]	3.50	
Settle	92	30	66.2	3.92	
Sloan	95	38	68.2	3.48	
Snowhill	96	35	68.8	3.22	
Southern Pines	94	35	69.2	3.06	
Southport	87	38	70.2	3.76	
Statesville	92	29	66.0	2.02	
Tarboro	98	34	69.4	2.17	
Vade Mecum	92	27	63.8	2.40	
Washington	96	36	68.4	1.75	
Wash Woods				2.44	
Waynesville	84	30	60.5	4.52	
Weldon	96	34	68.2	2.46	
Whitesville	96	36	69.2	2.52	
North Dakota.					
Amenia	96	24	51.6	4.06	
Ashley	92	24	52.2	5.32	
Berlin	84	26	51.6	6.37	0.5
Bottineau	95	21	49.4	4.08	T.
Broncho	94	32	55.5	6.41	
Buford	90	21	52.0	3.90	
Cando	94[d]	17[d]	49.2[d]	3.01	0.6
Chilcot				4.13	
Coalharbor	94	22	50.2	4.85	
Cooperstown	96	26	52.9	4.70	
Denhoff				4.70	
Dickinson	94	20	50.2	7.11	1.5
Donnybrook	94	21	48.0	5.13	T.
Dunseith	99	20	49.0	2.75	
Edgeley	93	24	52.0	5.59	
Edmore	97	12	50.8	2.35	0.2
Fargo	93	29[g]	54.4[d]	3.03	
Flasher	95	18	53.1	5.76	
Forman	94	26	54.4	7.16	
Fort Berthold	95	20	52.2	4.78	T.
Fullerton	91	24	51.7	8.08	1.0
Glenullin	93[c]	22[c]	49.9[c]	7.55	1.0
Grafton	97	17	50.1	2.77	
Hamilton	91	16	49.8	2.52	
Hannah	92	15	47.8	2.65	
Hillsboro	93	23	52.3	5.77	T.
Jamestown	99[b]			5.69	2.5
Kulm	93	25	51.6	6.46	0.8
LaMoure				5.05	
Langdon	91	23	49.2	3.54	
Larimore	99	20	49.0	3.80	0.1
Lisbon	93	21	50.6	5.38	
McKinney	94	20	49.8	2.81	1.0
Manfred	94	19	49.2	5.20	5.0
Medora	95	17	52.4	6.22	1.0
Melville	97	23	53.8	3.81	0.5
Milton	93	11	48.2	2.52	
Minot	95	25	49.5	5.30	0.5
Minto	97	21	50.7	2.68	
Moyersville	92	17	50.1	5.01	T.
Napoleon	95	18	50.4	3.29	0.5
Oakdale	91	22	50.5	7.87	0.7
Oriska	94	23	51.0	5.57	
Park River	98	20	51.2	2.96	T.
Pembina	92	13	49.4	2.70	T.
Portal	88	21	49.4	3.30	0.2
Power	94	22	53.0	3.90	T.
Pratt	96	25	50.5	4.75	1.0
Rolla	93	20	47.2	5.44	T.
Sentinel Butte	89	19	50.6	6.21	0.5
Steele	94	24	51.6	6.68	T.
University	95	21	52.0	3.05	0.5
Wahpeton	82	25	53.9	3.79	T.
Walhalla	95	13	50.0	3.36	
Washburn	96[c]	23[c]	56.4[c]	6.20	
Willow City	95[b]	21[b]	54.2[b]		
Wishek	93	24	50.3	4.45	
Ohio.					
Akron	86	30	60.2	1.48	T.
Amesville	94	26	63.4	1.54	T.
Atwater	86	30	57.6	2.19	
Bangorville	88	27	60.4	3.51	T.
Bellefontaine	89	24	60.8	3.23	T.
Benton Ridge	91	27	62.6	0.90	T.
Bladensburg	90	24	60.4	1.81	T.
Bowling Green	89	28	60.7	1.59	
Bucyrus	90	26	61.2	2.28	
Cadiz	89	29	62.3	1.84	T.
Cambridge	88	26	61.5	1.71	
Camp Dennison	93	29	63.6	2.46	
Canal Dover	88	26	60.4	3.04	
Canton	85	31	59.6	2.06	0.6
Cardington	88	24	60.0	2.94	T.
Circleville	90	27	62.8	1.83	T.
Clarington	91	30	63.0	2.75	T.
Clarksville	88	30	63.4	3.43	T.
Cleveland[b]	88	34	59.0	1.76	T.
Coalton	91	26	62.7	0.94	T.
Dayton	90	30	63.2	2.00	
Defiance	91	25	61.4	1.30	T.
Delaware	89	27	60.7	3.27	T.
Demos	90	33	61.8	1.77	T.
Findlay	94	28	62.8	1.07	
Frankfort	92	29	64.4	3.58	T.
Fremont	91	30	62.0	2.02	T.
Garrettsville	85	28	57.4	2.30	0.7
Granville	89	28	61.4	2.70	T.
Gratiot	87	26	60.4	3.49	0.1
Green	91	31	63.6	2.10	
Greenhill	84	28	57.4	1.53	0.1
Greenville	91	30	63.2	1.87	
Hedges	91	25	62.2	2.14	
Hillhouse	85	30	57.8	2.85	T.
Hiram	84	30	58.4	3.19	2.0
Hudson	89	27	58.8	2.47	T.
Ironton	94	30	66.0	2.03	
Jacksonburg	92	32	64.4	2.48	
Killbuck	86	29	60.4	2.77	T.
Lancaster	88	30	62.2	3.15	T.
Lima	88	32	62.8	2.97	
McConnelsville	89	26	61.7	1.93	T.
Manara	88	29	61.4	3.29	T.
Mansfield				2.40	
Marietta	91	32	64.6	2.86	
Marion	91	24	62.7	2.13	T.
Medina	86	30	60.2	1.96	1.0
Milfordton	87	26	59.2	2.74	T.
Milligan	91	25	61.8	1.99	
Millport	84	28	58.6	1.85	T.
Montpelier	89	27	59.8	2.69	
Napoleon	89	28	60.3	1.74	T
Nellie	87	31	61.0	3.43	T.
New Alexandria	89	29	62.0	1.55	T.
New Berlin	86	30	59.6	2.57	T.
New Bremen	90	27	63.1	1.62	T.
New Richmond	88	34	64.8	1.37	
New Waterford	87	32	60.0	2.16	T.
North Royalton	85	28	59.0	1.31	3.0
Norwalk	92	29	60.9	1.93	T.
Oberlin	89	29	59.4	2.63	T.
Ohio State University	87	27	60.8	2.92	
Orangeville	86	29	57.2	2.10	
Ottawa	92	27	62.4	1.52	T.
Pataskala	88	29	62.1	2.42	0.2
Philo	89	29	63.0	1.92	T.
Plattsburg	87	28	61.7	1.90	
Pomeroy	93	30	64.6	1.78	
Portsmouth	91	33	64.8	1.07	T.
Pulse				2.14	T.
Rittman	89	29	59.2	1.61	
Rockyridge	91	27	61.0	2.18	T.
Shenandoah	85	27	58.7	2.12	T.
Sidney	92	28	63.3	2.23	T.
Somerset	90	29	62.5	2.48	
South Lorain	90	30	59.6	2.30	T.
Springfield				2.19	T.
Summerfield	88	25	61.1	1.34	T.
Thurman	93	28	65.4	1.21	
Tiffin	88	32	61.1	0.88	T.
Toledo (St. Johns College)	90	32	60.4	2.76	T.
Upper Sandusky	87	31	62.2	2.03	T.
Urbana	90	24	61.6	2.81	T.
Vickery	91	30	59.0	2.37	
Warren	87	31	58.6	2.01	T.
Wauseon	91	25	60.3	1.49	0.2
Waverly	92	27	64.1	1.93	0.2
Waynesville	87	29	62.0	2.44	
Wellington	89	30	60.2	1.53	T.
Willoughby				1.47	
Wilson	90	27	62.6	2.46	T.
Wooster	86	29	59.9	2.98	T.
Zanesville				3.01	
Oklahoma.					
Alva	93	37	67.5	5.44	
Arapaho	98	39	69.0	5.88	
Ardmore	90	40	69.0	6.60	
Beaver	94[c]	39[c]	67.6[c]	1.61	
Binger	91[d]	37[d]	68.6[d]	2.17	
Blackburn	93	35	70.4	2.44	
Cache	94[c]	46[c]	70.8[c]	3.05[c]	
Chandler	95	38	71.4	2.87	
Chattanooga	91	40	72.0	4.55	
Dacoma	95	35	68.1	1.03	
Enid	95	35	67.9	1.80	
Fort Reno	92	43	68.2	1.30	
Fort Sill	90	40	69.0	4.81	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Oklahoma—Cont'd.	°	°	°	*Ins.*	*Ins.*
Gage	96	37	67.8	2.49	
Grande	.....	.....	.....	2.50	
Guthrie	92	38	70.0	2.99	
Harrington	96	39	65.8	4.80	
Helena	92	35	67.2	4.79	
Hennessey	93	36	68.8	2.14	
Hobart	94	41	69.9	3.15	
Jefferson	94	32	65.3	4.27	
Kenton	91	40	63.2	1.44	
Kingfisher	92	36	69.4	2.08	
McComb	91	40	67.4	1.33	
Mangum	96	43	72.1	5.60	
Meeker	94	36	68.8	1.28	
Neola	89	40	68.2	3.81	
Newkirk	95	36	70.0	0.81	
Pawhuska	90	38	69.2	1.88	
Perry	92	37	69.4[c]	2.53	
Sac and Fox Agency	91	40	70.0	1.72	
Shawnee	96	38	69.8	1.24	
Stillwater	91	37	68.2	4.44	
Temple	92	43	71.1	7.12	
Waukomis	93	35	68.1	2.59	
Weatherford	94	37	67.4	3.09	
Whiteagle	92	33	67.5	1.95	
Oregon.					
Alba	.....	.....	.....	3.51	
Albany	90	38	57.3	2.92	
Alpha	95	32	53.8	6.05	
Ashland	91	34	55.1	3.14	
Astoria	69	43	54.3	3.26	
Aurora (near)	87	35	55.5	1.43	
Bay City	65	35	51.2	5.43	
Bend	88	21	49.1	1.45	
Beulah	82	25	52.1	3.25	
Blackbutte	88	35	52.7	6.75	
Blalock	97	34	60.7	0.79	
Bullrun	85	38	53.8	4.56	
Burns	81	25	49.1	2.43	
Carlton	87	35	54.0	1.96	
Cascade Locks	89	39	57.6	3.77	
Coquille	.....	.....	.....	3.59	
Corvallis	88	34	55.0	3.07	
Dale	.....	.....	.....	2.84	
Dayville	90	30	55.3	1.85	
Doraville	89	36	53.0	3.43	
Drain	93	34	55.4	4.81	
Echo	94[b]	34[c]	61.1[c]	1.31	
Ella	92	35	59.6	1.41	
Eugene	84	37	55.0	3.08	
Fairview	81	35	54.1	7.13	
Falls City	85	31	53.4	4.50	
Forestgrove	89	31	55.6	2.43	
Gardiner	80	36	53.7	8.04	
Glendale	91	34	53.8	6.17	
Glenora	91	31	52.6	5.39	
Gold Beach	66	36	52.8	11.07	
Government Camp	78	27	44.2	4.62	10.0
Granite	80	21	46.0	3.60	T.
Grants Pass	90	33	55.5	4.05	
Grass Valley	85	25	50.2	1.05	
Heisler	89	24	54.8	0.74	
Heppner	91	32	56.2	2.95	
Hood River	88	33	56.7	1.52	
Huntington	88	28	58.2	1.15	
Jacksonville	92	32	55.8	3.06	
John Day	91	22	56.1[c]	3.14	
Joseph	84	26	48.2	3.53	
Kerby	91	34	53.8	5.81	
Klamath Falls	90	27	54.6	0.90	T.
Lagrande	87	27	52.6	4.97	
Lakeview	85	20	49.1	1.88	
Lonerock	87	25	50.8	2.40	
McKenzie Bridge	95	27	53.4	4.67	
McMinnville	89	33	55.0	2.49	
Marshfield	69	37	53.0	7.86	
Mill City	83	29	52.4	3.43	
Monroe	84	35	54.4	2.81	
Mountain Park	86	34	53.8	2.08	
Mount Angel	87	40	56.0	3.32	
Nehalem	.....	.....	.....	4.42	
Newport	61	39	52.1	5.40	
Odell	.....	.....	.....	2.68	
Olex	90	33	56.0	0.76	
Paisley	81	29	51.1	1.11	
Pendleton	90	30	55.4	3.36	
Port Oxford	68	39	52.0	7.60	
Prineville	86	26	52.0	1.23	
Prospect	78	24	46.9	4.10	
Richland	88	27	54.1	1.60	
Riley	.....	.....	.....	2.76	
Riverside	93	25	52.9	2.82	
Salem	86	42	56.6	1.85	
Silverlake	83	21	47.8	2.18	
Sparta	80	28	50.0	1.23	
Stafford	90	36	55.2	2.93	
The Dalles	89	37	59.9	0.95	
Toledo	79	34	52.5	4.70	
Umatilla	93	39	63.7	0.89	
Van	.....	.....	.....	2.24	
Wallowa	90	23	51.2	3.15	
Wamic	85	29	55.9	1.28	
Warm Spring	94	28	56.0	0.77	
Weston	88	26	53.6	6.44	
Williams	93	29	54.2	3.60	
Pennsylvania.					
Aleppo	87	27	61.1	2.00	T.
Altoona	89	31	58.8	2.44	
Baldwin	85	32	59.7	4.40	T.
Beaver Dam	.....	.....	.....	2.93	
Bellefonte	92	34	62.5	2.27	
Browers	.....	.....	.....	4.24	
California	89	30	61.8	3.53	T.
Cassandra	85	30	56.9	3.04	2.0
Centerhall	88	30	59.2	1.90	
Clarion	.....	.....	.....	3.36	
Claysville	91	26	61.2	1.97	T.
Clearfield	.....	.....	.....	2.74	T.
Coatsville	93	32	62.7	4.55	
Confluence	.....	.....	.....	3.56	
Davis Island Dam	.....	.....	.....	2.44	
Derry	90	31	61.3	2.32	T.
Doylestown	.....	.....	.....	3.34	
Dushore	85	29	54.6	3.41	0.1
East Mauch Chunk	95	28	60.8	2.90	
Easton	89	35	62.6	4.51	
Ellwood Junction	.....	.....	.....	2.46	
Emporium	86	32	57.8	5.59	T.
Ephrata	91	33	61.6	4.43	
Everett	89	26	59.6	3.65	T.
Forks of Neshaminy	.....	.....	.....	4.70	
Franklin	87	28	58.4	2.89	T.
Freeport	89	31	60.8	3.57	
Gettysburg	94	32	62.8	3.28	
Girardville	.....	.....	.....	3.41	T.
Gordon	90	24	58.6	2.58	T.
Greensboro	.....	.....	.....	2.78	T.
Greenville	88	30	58.6	3.08	T.
Hamburg	97	28	62.0	2.31	
Hanover	94	32	64.6	3.46	
Herrs Island Dam	.....	.....	.....	2.01	
Huntingdon	90	29	60.8	3.67	
Hyndman	.....	.....	.....	0.93	
Indiana	88	31	59.4	3.35	
Irwin	91	31	62.8	2.39	T.
Johnstown	91	30	61.8	2.60	T.
Kennett	89	33	62.0	4.57	
Lansdale	.....	.....	.....	2.65	
Lawrenceville	90	23	56.8	5.08	T.
Lebanon	93	33	61.4	2.43	
Leroy	88	26	56.3	4.97	T.
Lewisburg	93	31	61.0	2.09	
Lockhaven	94	33	62.4	2.88	
Lock No. 4	.....	.....	.....	4.07	
Lycippus	88	31	62.0	2.78	T.
Marion	99	32	63.1	2.06	
Mifflintown	90	31	61.0	2.67	
Milford	91	25	57.8	4.78	
Montrose	85	26	54.7	3.32	T.
New Germantown	90	34	61.2	2.73	
Ottsville	.....	.....	.....	3.94	
Parker	.....	.....	.....	3.22	
Penmar	.....	.....	.....	2.54	T.
Philadelphia	93	39	64.6	4.47	
Pocono Lake	85	27	54.6	4.56	
Point Pleasant	.....	.....	.....	4.94	
Pottsville	.....	.....	.....	4.17	
Reading	93	35	63.3	4.64	
Renovo	.....	.....	.....	3.22	
Saegerstown	85	27	57.0	3.08	T.
St. Marys	85	30	55.8	3.96	
Saltsburg	.....	.....	.....	2.39	
Seisholtzville	.....	.....	.....	3.97	
Selinsgrove	91	31	61.0	3.20	
Shawmont	.....	.....	.....	2.80	
Skidmore	86	30	59.2	2.60	T.
Smiths Corners	.....	.....	.....	5.38	
Somerset	86	28	56.4	2.85	T.
South Eaton	87	28	58.1	3.87	
Springdale	.....	.....	.....	2.82	
Springmount	.....	.....	.....	4.15	
State College	86	31	59.0	1.81	T.
Towanda	88	27	57.0	4.43	0.1
Uniontown	87	31	62.4	1.77	T.
Warren	89	28	57.6	2.07	
Wellsboro	83	23	55.7	4.22	T.
Westchester	92	34	63.0	4.21	
West Newton	.....	.....	.....	1.71	
Wilkesbarre	91	33	60.2	1.89	T.
Williamsport	90	32	61.0	2.14	
Rhode Island.					
Bristol	80	41	56.7	4.63	
Kingston	86	32	56.4	4.56	
Pawtucket	92	39	60.8	6.11	
Providence	90	39	60.9	4.64	
South Carolina.					
Aiken	97	43	72.0	2.30	
Allendale	95	43	71.6	2.32	
Anderson	93	38	69.4	4.93	
Barksdale	94[f]	42[f]	69.6[f]	4.40	
Batesburg	95	36	70.0	2.61	
Beaufort	90	45	72.2	5.11	
Bennettsville	97	38	70.4	3.85	
Blackville	97	38	72.3	5.45	
Blair	.....	.....	.....	2.67	
Bowman	97	36	70.8	1.59	
Calhoun Falls	.....	.....	.....	5.50	
Camden	.....	.....	.....	4.30	
Chappells	.....	.....	.....	2.96	
Cheraw	91	37	68.8	2.32	
Clarks Hill	93	36	70.0	3.53	
Clemson College	89	39	69.0	2.74	
Conway	97	40	70.3	2.41	
Darlington	98	38	69.5	2.92	
Dillon	97	35	70.0	2.24	
Due West	91	40	69.4	2.85	
Edisto	.....	.....	.....	1.99	
Effingham	.....	.....	.....	2.75	
Enoree	.....	.....	.....	3.68	
Florence	99	38	70.8	2.12	
Gaffney	95	37	68.2	2.36	
Georgetown	90	45	69.9	2.26	
Greenville	89	32	64.3	3.24	
Greenwood	93	39	69.7	1.68	
Heath Springs	96	46	72.0	3.33	
Kingstree	93	48	74.6	2.40	
Liberty	95	38	69.4	3.36	
Little Mountain	94	39	69.9	2.79	
Newberry	96	36	70.5	4.50	
Pelzer	.....	.....	.....	2.92	
St. Georges	93	49	73.6	2.47	
St. Matthews	90	42	69.8	2.61	
St. Stephens	.....	.....	.....	2.49	
Saluda	96	35	70.0	1.98	
Santuck	95	36	68.9	2.62	
Walhalla	95	37	68.6	2.82	
Walterboro	93[e]	43	69.6	5.07	
Winnsboro	93	40	69.4	1.85	
Winthrop College	93	35	69.6	1.93	
Yemassee	95	40	70.0	4.63	
Yorkville	96	38	70.4	1.82	
South Dakota.					
Aberdeen	95	26	55.6	12.39	T.
Academy	92	27	59.6	4.75	
Alexandria	96	30	59.2	3.49	
Armour	96	28	60.3	3.57	
Bellefourche	.....	.....	.....	5.55	T.
Bowdle	93	25	54.3	7.30	
Brookings	91	24	55.7	3.51	
Canton	94	30	59.0	3.78	
Castlewood	99	25	55.0	3.49	T.
Centerville	94	31	59.8	3.16	T.
Chamberlain	94	26	60.1	4.92	T.
Cherry Creek	97	23	57.5	5.01	T.
Clark	92	26	53.9	4.27	
Clear Lake	90	24	55.9	3.83	T.
Desmet	92	28	56.6	3.37	T.
Doland	92	30	57.6	4.08	T.
Elkpoint	94	30	62.2	2.18	
Fairfax	99	23	58.7	4.15	
Farmingdale	.....	.....	.....	4.90	
Faulkton	92	27	55.4	6.81	T.
Flandreau	95	27	57.0	3.85	T.
Forestburg	95	27	57.6	3.53	
Fort Meade	85	26	52.1	5.37	T.
Gannvalley	96	28	58.6	4.49	
Grand River School	.....	24	49.8[d]	7.09	T.
Greenwood	92	29	62.0	2.54	
Hermosa	89	24	54.1	3.79	T.
Highmore	93	26	56.9	5.00	T.
Hitchcock	.....	.....	.....	4.50	
Hotch City	97	23	58.4	3.45	
Howard	93	26	57.4	2.09	T.
Howell	94	26	56.4	5.94	T.
Ipswich	93	25	55.0	12.00	T.
Kidder	93	26	53.6	8.19	T.
Kimball	95	25	58.8	6.11	
Leola	92	23	53.3	10.08	
Mellette	94	25	58.2	8.85	T.
Menno	96	28	60.2	5.21	
Milbank	93	22	54.5	6.29	T.
Mitchell	96	30	60.0	3.15	
Oelrichs	88	24	53.6	3.66	
Pine Ridge	89	22	57.0[e]	3.63	
Plankinton	.....	.....	.....	3.47	
Ramsey	95	24	58.0	7.82	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Redfield	93	27	56.8	4.50	
Rosebud Agency	93	27	58.2	4.56	
Roslyn	91	26	53.3	6.10	T.
Rousseau				4.61	
Sioux Falls	95	27	59.4	4.56	
Spearfish	86	28	52.9	6.40	
Stephan	92	26	56.8	5.33	T.
Tyndall	94	28	60.7	4.05	
Watertown	89	27	54.6	4.30	
Wentworth	94	28	57.2	3.13	
Whitehorse	90	24	55.0	5.48	
Woolsey				3.05	
Tennessee.					
Andersonville	90	33	64.8	5.69	
Arlington	93	41	68.2	3.85	
Ashwood	88	35	65.4	3.51	
Benton	93	32	67.0	2.22	
Bluff City				3.10	
Bolivar	91	37	67.6	2.40	
Brownsville	89	42	68.5	4.76	
Byrdstown	89	33	65.9	4.88	
Carthage	90	33	67.0	4.73	
Catlettsburg				3.40	
Cedar Hill	95	38	69.4	3.70	
Celina				3.88	
Charleston				1.26	
Clarksville	88	39	67.0	3.75	
Clinton				3.73	
Covington	90	41	68.6	2.58	
Dandridge				3.72	
Decatur	93	31	67.6	2.22	
Dickson	91	32	65.6	1.95	
Dover	93	35	67.6	1.98	
Dyersburg	92	41	68.7	4.11	
Elizabethton	90	28	64.4	3.43	T.
Erasmus	87	29	61.3	3.28	
Florence	87	36	66.6	2.95	
Franklin	88	37	65.9	3.08	
Greeneville	86	32	64.2	4.46	
Halls Hill				2.19	
Harriman	89	34	66.6	3.85	
Hohenwald	89	27	63.2	2.68	
Iron City	90	32	66.2	2.28	
Jackson	93	37	68.9	2.48	
Johnsonville	92	35	67.3	1.74	
Jonesboro	88	30	63.3	3.56	
Kenton	92	39	68.8	3.52	
Kingston				3.77	
Lafayette	90	33	65.1	3.04	
Leadvale				2.81	
Lewisburg	93	34	68.0	3.17	
Loudon				3.00	
Lynnville	88	35	66.0	4.17	
McGee				2.35	
McMinnville	90	32	66.8	3.23	
Maryville	91	36	66.8	5.44	
Milan	91	39	67.3	2.65	
Monterey	86	33	64.8	3.57	
Newport	87	39	68.3[c]	4.16	
Palmetto	92	34	67.2	4.31	
Pope	92	32	66.8	2.98	
Rogersville	90	31	65.1	2.39	
Rugby	89	27	62.8	3.50	
Savannah	92	34	67.4	2.03	
Sevierville	90	31	66.1	4.39	
Sewanee	86	35	65.2	5.23	
Silver Lake	83	30	60.4	3.76	T.
Sparta	89	31	69.4	3.72	
Springdale	93	27	65.2	4.01	
Springville	91	35	66.3	2.20	
Tazewell				3.03	
Tellico Plains	92	31	67.4	2.12	
Tracy City	87	29	63.2	5.23	
Trenton	92	36	67.0	1.28	
Tullahoma	91	31	66.6	2.81	
Union City	91[c]	38[f]	68.5[d]	4.86	
Walling				4.17	
Watertown	93	33	67.0	2.25	
Waynesboro	91	33	66.1	2.28	
Yukon	91	37	68.3	3.51	
Texas.					
Albany	97	36	71.9	4.57	
Alvin				0.06	
Arthur				5.66	
Austin	94	41	75.8	1.65	
Ballinger	104	40	74.2	2.95	
Barstow	104	44	74.2	0.53	
Beaumont				0.48	
Beeville	98	57	77.0	2.56	
Big Spring	103	38	74.2	3.52	
Blanco	94	41	71.4	1.60	
Boerne	100	45	73.0	1.20	
Booth				0.86	
Bowie	92	43	70.8	8.77	
Brazoria	93	54	75.4	1.40	
Brenham	97	51	74.6	3.23	
Brighton	88	59	76.4[d]	1.63	
Brownwood	99	42	73.6	4.50	
Channing	90	38	65.3	1.54	
Clarksville	93	41	72.3	4.69	
Claude				1.30	
Claytonville	97	35	69.5	2.00	
College	101	54	76.9	2.09	
Colorado	97	36	72.5	6.01	
Columbia	95	54	75.7	0.85	
Columbus				1.30	
Corsicana	94	51	73.3	5.54	
Crockett	94	45	74.0	4.30	
Cuero	100	51	79.2	0.83	
Dallas	93	45	71.1	7.19	
Dalhart				2.50	
Danevang	99	50	77.0	1.33	
Denison				9.88	
Dialville	94	46	72.5	3.00	
Dublin	94	54	73.4		
Duval	96	47	75.6	1.05	
Eagle Pass	107	60	80.6	4.02	
Fort Brown	96	61	79.0	1.57	
Fort Clark	96	54	75.2	1.40	
Fort McIntosh	109	54	79.8	4.05	
Fort Ringgold	107	57	82.0	1.14	
Fort Stockton	102	38	72.0	1.02	
Fredericksburg	97	47	72.9	1.73	
Gainesville	91	43	69.6	9.08	
Gatesville	98	40	74.0	5.23	
Georgetown	98	42	74.3	1.46	
Gonzales				0.81	
Graham	96	38	72.4	7.71	
Grapevine	93	48	72.4	6.51	
Greenville	89	45	67.8	5.13	
Hale Center	90	44	65.7	2.28	
Hallettsville	97	52	77.5	1.08	
Haskell	100	36	71.6	5.93	
Hearne	97	48	74.6	3.86	
Hempstead				2.20	
Henrietta	95	41	70.6	5.06	
Hereford	91	38	65.1	1.06	
Hewitt				3.00	
Hillsboro	96	44	72.8	6.92	
Hondo	99	54	75.8	9.09	
Houston	98	45	77.6	0.15	
Jefferson	89	44	72.0	6.34	
Jewett	92	46	72.1	2.06	
Junction				3.91	
Kaufman	94	45	73.8	4.88	
Kent	95	40	69.8	0.10	
Kerrville	99	50	74.0	5.06	
Knickerbocker	101	42	73.2	1.87	
Kopperl				3.88	
Lampasas	100	43	73.0	2.15	
Liberty	100	43	76.6	0.80	
Llano	102	43	74.9	1.00	
Longlake				2.32	
Longview	93	46	73.8	3.44	
Luling	97	53	75.6	0.88	
Marlin	103	46	74.8	3.30	
Menardville				4.58	
Mexia	97	46	72.1	3.62	
Miami	93	39	67.2	3.99	
Mobeetie					
Mount Blanco	95	35	68.2	1.29	
Mount Pleasant	94	42	71.6	1.75	
Nacogdoches	92	45	71.9	1.54	
Nazareth				0.95	
New Braunfels	96	52	75.6	0.61	
Orange				0.10	
Panter				4.43	
Paris	95	44	71.8	5.58	
Port Lavaca	95	53	76.6	0.23	
Quanah				3.45	
Rhineland	96	34	68.9	7.50	
Riverside				2.08	
Rockisland	95	50	75.0	1.14	
Rockland				3.30	
Rockport	84	58	73.2	1.80	
Runge				0.08	
Sabinal	104	54	76.2	6.51	
San Marcos	99	51	75.2	1.02	
San Saba	101	41	73.6	3.28	
Santa Gertrude				3.42	
Seymour	97	37	70.4	5.45	
Sherman	89	48	71.5	6.91	
Sonora	97	46	71.8	4.47	
Sugarland	96	50	75.2	2.84	
Sulphur Springs	91	44	72.2	1.97	
Temple	99	45	73.3	1.85	
Texline	87	35	62.1	1.11	
Trinity	100	44	75.2	1.54	
Tyler	96	45	73.2	5.85	
Valley Junction				4.93	
Victoria	96	55	66.4	0.63	
Waco	100	49	76.6	5.15	
Waxahachie	95	42	72.3	6.72	
Weatherford	95	42	71.4	5.17	
Wharton	97	55	76.8	1.10	
Wichita Falls				4.65	
Willspoint				4.62	
Utah.					
Alpine				4.13	
Aneth	89	34	64.1	0.25	
Beaver	87	25	52.9	1.86	
Black Rock	83	29	55.4	0.91	
Blacksmith Fork				4.22	1.0
Castledale	80[g]	18[d]	51.3[d]	0.60	
Castle Rock				4.24	10.0
Cedar City	79	30	56.8	0.72	3.2
Clear Creek				3.50	
Corinne	92	32	56.2	3.35	
Coyoto	78	25	50.8	0.31	T.
Deseret	83	28	55.7	1.96	T.
Emery	80	28	53.8	0.75	
Enterprise				0.44	
Farmington	92	26	56.6	4.47	
Fillmore	86	29	58.4	2.18	
Fort Duchesne	86	30	56.4	1.19	
Garrison	83	25	56.1	0.77	
Giles	88	32	61.2	0.72	
Government Creek	78	26	52.6	2.14	
Grayson	82[c]	27	56.9[b]	1.10	
Green River	92	34	61.4	0.90	
Heber	88	26	51.6	2.61	
Henefer	80	23	50.6	3.78	
Hite	91	41	68.4	0.45	
Huntsville				3.56	
Ibapah	81	19	51.2	1.25	
Indianola				0.19	
Kanab	82[f]	20[g]	54.4[g]	0.10	
Kelton	69	13	40.2	1.83	
Levan	80	28	53.6	3.30	T.
Loa	78	23	50.8	0.35	
Logan	79	33	52.2	5.05	
Lucin	82	18	53.3	T.	
Manti	80[d]	30[c]	54.2[d]	1.96	
Marion				3.09	
Marysvale	81	26	52.6	0.65	T.
Meadowville	74	25	48.4	4.10	2.0
Millville				4.64	
Moab	89	37	62.7	1.79	
Morgan	79	26	51.8	3.86	
Mount Nebo	82	31	56.8	1.71	
Nephi				3.35	
Oak City	84	27	57.4	2.31	
Ogden	82	35	56.6	5.63	
Panquitch				0.90	
Parowan	82	26	54.4	0.62	1.5
Payson				2.83	
Pinto	75	25	49.8	0.93	
Plateau	75	23	48.8	1.17	0.2
Provo	93	31	60.0	2.80	
Ranch	73	24	48.4	0.64	
Randolph				2.02	T.
Richfield	83	30	55.4	1.30	
Rockville	93	39	67.1	0.45	
St. George	94	40	66.0	0.39	
Salt Air	81	39	55.8	2.13	
San Juan				1.24	
Scipio	81	24	52.9	2.12	
Snowville	82	22	51.3	3.54	
Soldier Summit	72	22	49.1	1.17	7.7
Strawberry Valley	69[c]	21[c]	44.6[c]	2.63	4.0
Sunnyside				1.52	
Theodore	83	29	54.4	0.61	
Thistle	96	30	57.2	2.28	
Tooele	81	30	55.2	2.66	
Tropic	77	25	52.4	0.86	T.
Trout Creek	88	30	56.0	1.92	
Utah Lake	81	31	53.4	2.35	
Vernal	81	31	56.0	2.55	
Wellington	82	27	55.4	0.42	
Vermont.					
Cavendish	90	26	53.8	4.73	
Chelsea	83	26	50.2	3.61	T.
Cornwall	89	31	54.5	3.10	T.
Enosburg Falls	90	28[d]	53.4	3.26	
Jacksonville	85	26	53.6	5.39	
Manchester	82	28	54.2	6.95	T.
Norwich	88	25	52.2	6.60	T.
St. Johnsbury	92	25	54.3	3.71	
Wells	84	30	52.5	6.39	
Westfield				4.20	
Woodstock	86	26	52.7	6.92	
Virginia.					
Arvonia	97	28	66.2	3.86	
Ashland	91	34	65.6	2.74	
Barboursville	90	35	66.0	2.18	
Bigstone Gap	85	33	63.2	3.40	
Blacksburg	86	23	59.6	1.28	T.
Buchanan				2.13	
Burkes Garden	78	22	56.1	4.27	T.
Callaville	94	31	65.7	3.17	
Charlottesville	92	35	66.3	2.85	
Clarksville				3.30	
Columbia	93	30	65.0	3.31	
Dale Enterprise	91	28	61.7	2.77	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Danville	.....	.....	.....	4.63	
Dinwiddie	94	27	65.3	4.18	
Doswell	96[e]	30[e]	66.4[e]	3.00	
Elk Knob	83	32	63.6	4.02	
Farmville	92	30	65.2	2.86	
Fredericksburg	92	30	64.8	3.88	
Grahams Forge	84	29	60.9	2.62	T.
Hampton	92	39	66.7	3.68	
Hot Springs	84	28	58.8	2.45	T.
Ivanhoe	.....	.....	.....	1.97	
Lexington	93	28	63.0	2.36	
Lincoln	96	27	64.0	3.55	
Marion	85	30	60.7	2.51	T.
Mendota	.....	.....	.....	4.15	
Milford	95	32	67.2	2.08	
Newport News	90	41	67.0	2.76	
Nokesville (near)	90	32	63.3	2.15	T.
Petersburg	93	29	66.8	3.43	
Quantico	93	28	64.8	2.74	
Radford	.....	.....	.....	1.98	
Randolph	.....	.....	.....	2.88	
Riverton	.....	.....	.....	3.1[c]	
Roanoke	.....	.....	.....	5.17	
Rockymount	92	29	64.8	1.53	
Shenandoah	.....	.....	.....	1.86	
Skyland	.....	.....	.....	2.41	0.2
Speers Ferry	.....	.....	.....	4.50	
Spottsville	96	31	66.2	3.59	
Staunton	90	33	64.0	2.70	
Stephens City	95	31	64.5	1.89	
Warsaw	93	29	65.5	2.54	
Williamsburg	90	33	65.6	2.57	
Woodstock	96	31	64.8	2.45	T.
Washington.					
Aberdeen	80	37	52.4	3.83	
Anacortes	69	40	53.4	3.62	
Ashford	.....	.....	.....	6.05	
Baker	86	35	56.2	3.25	
Bellingham	71	38	54.0	4.67	
Blaine	72	36	54.0	3.76	
Bremerton	79	29	55.3	1.78	
Brinnon	73	38	53.7	3.14	
Cedonia	86	30	55.7	3.56	
Centralia	88	30	53.8	4.38	
Cheney	80	30	54.5	3.43	
Clearbrook	83	28	51.9	4.02	
Clearwater	72	35	51.6	5.20	
Cle Elum	85	26	50.7	2.01	
Colville	91	24	55.6	3.24	
Conconully	84	30	54.6	4.05	
Coupeville	72	39	54.0	3.47	
Crescent	88	28	53.5	3.69	
Cusick	89	24	54.3	3.61	
Danville	87	28	55.9	2.63	
Dayton	91	35	55.6	4.13	
Easton	.....	.....	.....	6.04	
East Sound	74[e]	32[e]	53.0[e]	4.16	
Ellensburg	89	30	55.7	1.23	
Ephrata	92	36	60.6	1.41	
Fort Simcoe	88	34	56.6	1.56	
Goldendale	85	30	54.2	1.05	
Grandmound	87	29	53.6	4.01	
Granite Falls	.....	.....	.....	4.73	
Hatton	94	32	58.4	1.27	
Horse Heaven	.....	.....	.....	1.30	
Ilwaco	71	41	53.0	3.68	
Kennewick	93	32	62.2	0.93	
Kiona	92	33	61.4	0.68	
Kosmos	91	32	53.9	3.09	
Lacenter	90	35	54.5	2.48	
Lakeside	87	39	59.4	1.79	
Lester	88	29	52.3	4.00	T.
Lind	92	34	57.3	1.65	
Loomis	90	36	59.4	4.10	
Merritt	.....	.....	.....	1.85	
Mottinger Ranch	93	39	63.2	1.56	
Mount Pleasant	84	27	52.4	3.91	
Moxee	89	28	58.2	1.11	
Northport	88	21	53.5	2.16	
Odessa	91	29	56.5	1.66	
Olga	68	39	53.3	4.27	
Olympia	87	32	55.2[d]	4.77	
Pinehill	89	35	57.2	1.28	
Pomeroy	93	29	57.2	3.22	
Port Townsend	70	42	53.4	3.52	
Pullman	89	29	51.6	2.54	
Quinisult	85	34	53.8	6.86	
Rattlesnake	83	33	54.5	1.70	
Republic	87	23	52.8	3.92	
Rex Creek	80	41	57.1	2.81	
Ritzville	.....	.....	.....	1.54	
Rock Lake	.....	.....	.....	3.51	
Rosalia	87	32	53.2	3.19	
Sedro	78	33	53.3	5.71	
Sixprong	92	37	59.0	0.67	
Snohomish	79	34	54.2	3.53	
Snoqualmie	85	33	54.2	4.59	
Southbend	79	39	54.3	3.43	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Washington—Cont'd.	°	°	°	*Ins.*	*Ins.*
Stehekin	80	36	54.8	2.99	
Sunnyside	88	34	58.4	0.98	
Touchet	94	31	59.5	2.34	
Trinidad	92	40	60.9	1.00	
Twisp	88	28	55.0	4.05	
Union	82	33	55.1	3.98	
Vancouver	92	37	57.4	2.41	
Vashon	73	37	54.0	2.37	
Wahluke	92	39	61.5	0.74	
Waterville	86	34	54.6	1.95	
Wenatchee (near)	83	39	55.8	1.48	
Wilbur	87	24	55.0	3.68	
Winthrop	86	27	55.6	3.06	
Wynooche	88	30	53.4	4.60	
Yale	94	37	55.4	4.79	T.
Zindel	99[e]	40[e]	60.2[e]	2.98	
West Virginia.					
Bancroft	91	31	63.4	2.30	T.
Bayard	84	23	56.8	2.57	T.
Bens Run	91	31	64.0	6.89	T.
Berkley Springs	98	30	65.4[e]	2.50	T.
Bluefield	84	31	61.0	2.00	T.
Buckhannon	85	28	60.8	2.76	T.
Burlington	90	28	61.0	1.22	
Cairo	94[l]	28[l]	64.7[l]	1.77	
Central	90	26	61.9	2.00	T.
Charleston	88	36	66.8	2.25	
Creston	90	29	63.0	1.61	
Cuba	89	27	62.6	1.28	
Doane	90	30	64.8	3.30	
Elkhorn	86	32	62.8	2.83	T.
Fairmont	91	28	62.5	1.59	
Franklin	98	29	60.8	1.66	T.
Glenville	92	31	64.4	1.51	
Grafton	89	28	61.9	2.99	T.
Green Sulphur Springs	87	30	60.2	1.79	
Harpers Ferry	.....	.....	.....	1.75	
Hinton	.....	.....	.....	2.56	
Huntington	92	32	64.8	1.84	
Leonard	79	24	59.0	.....	
Lewisburg	85	28	60.6	3.30	T.
Logan	91	35	65.8	3.61	
Lost City	90	34	66.0	2.60	
Lost Creek	89	28	62.1	3.12	T.
Madison	90	32	63.1	4.02	T.
Mannington	90	28	61.8	2.65	
Martinsburg	94	34	63.6	1.00	
Moorefield	96	27	63.8	1.50	T.
Mooresville	.....	.....	.....	2.38	T.
Morgantown	86	30	62.9	3.14	T.
Moundsville	90	31	63.8	2.11	T.
New Cumberland	85	32	61.0	3.05	T.
New Martinsville	93	32	65.2	2.95	
Nuttallburg	82	22	54.4	1.75	
Oceana	93	31	66.8	0.39	
Parsons	87	25	58.8	2.09	
Philippi	91	29	61.9	2.45	T.
Pickens	84	27	57.8	5.48	T.
Point Pleasant	91	33	66.0	1.24	
Powellton	90	31	64.8	3.32	
Princeton	82	30	58.6	2.85	T.
Romney	96	32	66.4	1.28	T.
Rowlesburg	.....	.....	.....	2.86	
Ryan	90	29	62.4	4.04	T.
Smithfield	90	27	61.3	1.79	
Southside	93	29	65.2	3.86	T.
Spencer	91	28	61.2	2.70	
Sutton	92	31	64.0	5.55	T.
Terra Alta	84	28	59.7	3.82	T.
Union	84	28	63.2	1.80	
Uppertract	90	27	61.4	1.52	T.
Valley Fork	91	28	62.4	2.97	T.
Webster Springs	90	29	62.8	3.30	T.
Wellsburg	84	32	60.8	2.03	
Weston	84	27	62.4[k]	2.83	
Wheeling	.....	.....	.....	1.16	
Williamson	91	36	66.6	4.32	
Wisconsin.					
Amherst	90	26	55.0	4.29	3.5
Antigo	88	22	53.4	.....	
Appleton	85	23	55.2	1.87	0.1
Appleton Marsh	86	26	53.8	6.02	4.5
Ashland	79	30	47.8[e]	3.59	T.
Barron	80	22	54.1	7.45	1.0
Beloit	86	32	59.1	2.64	
Berlin	89	28	54.0	3.67	4.5
Black River Falls	.....	.....	.....	4.61	
Brodhead	91	29	59.5	3.24	
Burnett	85	30	55.4	3.16	4.0
Butternut	80	21	51.8	4.11	T.
Chilton	86	31	55.4	4.10	4.0
Chippewa Falls	.....	.....	.....	5.12	
City Point	89	29	57.8	5.26	
Downing	80	21	54.6	8.44	
Eau Claire	85	29	57.6	7.20	
Florence	88	28	50.0	2.51	T.
Fond du Lac	87	27	55.8	2.80	4.0
Grand Rapids	87	30	56.2	3.62	2.0

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Wisconsin—Cont'd.	°	°	°	*Ins.*	*Ins.*
Grand River Locks	.....	.....	.....	4.62	2.0
Grantsburg	81	20	53.6	4.95	2.0
Haucock	87	27	56.0	4.42	4.0
Harvey	87	30	57.2	2.82	T.
Hayward	80	20	51.0	4.33	T.
Hillsboro	87	25	55.8	5.14	0.5
Koepenick	90	20	54.2	4.30	T
Manitowoc	86	31	51.2	2.72	T.
Mauston	87	29	56.6	3.93	1.0
Meadow Valley	88	25	55.0	5.63	3.0
Medford	88	25	54.4	5.40	1.0
Menasha	.....	.....	.....	3.04	T.
Merrill	86	24	54.2	5.21	0.5
Mount Horeb	88	28	57.3	5.59	T.
Neillsville	86	24	55.8	.....	
New London	87	29	55.8	3.02	T.
New Richmond	82	24	56.5	7.89	T.
Oconto	88	31	54.4	4.13	
Osceola	81	16	54.8	6.61	T.
Oshkosh	87	29	55.8	3.18	T.
Pine River	89	28	55.4	2.67	4.0
Portage	88	30	57.6	3.10	T.
Port Washington	88	31	51.3	3.55	2.0
Prairie du Chien	90	31	59.7	4.93	.....
Prentice	82	20	52.3	3.51	0.5
Racine	89	31	55.3	1.50	
Sheboygan	88	32	52.0	2.59	2.5
Shullsburg	86	27	58.0	4.92	
Spooner	84[f]	17[f]	53.2[f]	7.68	T.
Stanley	81	22	54.8	6.95	T.
Stevens Point	90	25	54.2	2.86	
Sturgeon Bay	82	27	49.2	4.49	T.
Valley Junction	77	25	52.4	5.43	6.0
Viroqua	91	30	58.0	7.92	T.
Watertown	89	28	57.1	2.83	T.
Waukesha	.....	.....	.....	2.08	T.
Waupaca	87	30	56.6	2.63	0.8
Wausau	85	27	54.6	4.85	1.5
Whitehall	81	22	55.8	4.33	
Wyoming.					
Afton	80	24	46.6	6.50	
Alcova	86	23	54.0	3.57	
Barnum	.....	.....	.....	3.49	.....
Basin	90	20	51.5	1.10	
Border	78	18	47.1	3.63	
Buffalo	84	22	50.2	4.42	6.4
Cambria	87	22	52.5	5.69	.....
Chugwater	82	22	52.1	2.72	
Clark	85	29	53.0	2.23	
Cody	84	23	52.2	1.79	2.5
Daniel	76	15	41.1	3.32	.....
Elk Mountain	.....	.....	.....	3.06	6.0
Embar	80	23	51.6	1.72	2.0
Evanston	73	12	45.9	4.51	11.0
Fayette	74	15	43.8	.....	.....
Fort Laramie	90	24	54.4	3.18	
Gillette	85	30	55.5	3.79	
Granite Canyon	72	23	47.0	2.11	T.
Granite Springs	.....	.....	.....	1.82	
Green River	90	26	51.6	2.30	T.
Griggs	83	26	51.4	4.29	7.5
Hatton	.....	.....	.....	1.31	.....
Hyattville	95	23	55.8	.....	
Jackson	74	14	44.5	4.28	T.
Kirtley	81	23	49.7	4.29	
Laramie	74	19	47.4	0.91	T.
Leo	76	16	48.1	1.96	
Little Medicine	73	13	44.9	2.10	T.
Lolabama Ranch	.....	.....	.....	3.61	
Lusk	86	20	50.3	4.49	3.0
Moorecroft	88	27	52.6	3.08	
Moore	81	22	50.4	2.51	T.
Pathfinder	84	21	54.4	2.18	0.5
Phillips	84	29	53.0	2.25	
Pine Bluff	84	26	52.8	2.86	T.
Pinedale	78	15	44.4	2.25	2.0
Rawlins	89	23	52.0	1.78	T.
Saratoga	77	20	50.4	1.63	2.5
Sheridan	87	21	51.4	4.65	
Shoshone Canyon	82	25	50.4	2.63	1.8
South Pass City	74	13	41.8	3.07	12.0
Thayne	76	19	46.0	6.30	2.5
Wells	69	17	41.5	3.85	4.0
Wheatland	91	26	58.2	3.35	
Wolf	83	30	51.7	4.55	
Yellowstone Pk. (Norris)	74[b]	15[b]	42.4[b]	.....	
Yellowstone Pk (Riv's'de)	72	14	43.2	1.78	4.2
Yellowstone Pk (Snake R.)	70	0	40.6	.....	2.0
Yellowstone Pk. (Soda R.)	74	14	43.4	3.05	.....
Yellowstone Pk. (Thumb)	.....	6	.....	3.32	16.0
Yellowstone Pk. (Up B.)	69	15	41.2	3.58	.....
Porto Rico.					
Adjuntas	91	51	72.4	6.72	
Aguirre	94	67	80.4	2.44	
Albonita	85	58	70.5	1.55	
Anasco	92	64	78.8	11.17	
Arecibo	91	59	75.1	4.27	
Barros	90	60	74.7	5.20	

TABLE II.—*Climatological record of cooperative observers*—Continued. *Late reports for April, 1906.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Porto Rico—Cont'd.	°	°	°	*Ins.*	*Ins.*
Bayamon	94	61	77.0	4.19	
Caguas	98	59	79.0	2.42	
Canovanas	93	64	80.1	4.01	
Cayey	89	69	78.8	2.69	
Cidra	92	57	74.2	.....	
Coamo	93	67	81.0	0.23	
Coloso	89	64	77.4	8.99	
Carozal	92	52	75.4	3.47	
Fajardo	91	69	80.4	3.58	
Guanica	92	63	78.0	4.04	
Hacienda Josefa	.....	.....	.....	1.02	
Juana Diaz	91	69	79.6	2.99	
La Carmelita	86	60	73.6	10.43	
La Ysolina	90	59	74.0	6.43	
Lares	92	59	75.8	8.14	
Las Cruces	85	61	71.3	9.27	
Las Marias	89	62	75.6	10.02	
Manati	98	64	78.6	2.07	
Maunabo	94	69	82.2	4.62	
Ponce	91	67	79.3	2.17	
Rio Blanco	90	60	78.4	4.62	
Rio Piedras	.....	.....	.....	2.06	
San German	90	58	76.0	4.87	
San Lorenzo	95	60	77.2	3.67	
San Salvador	88	59	73.0	7.61	
Santa Isabel	91	65	78.4	2.37	
Vieques	92	69	81.2	3.12	
Yabucoa	.....	.....	.....	4.91	
Yauco	90	64	78.4	3.47	
New Brunswick.					
St. John	66	34	47.3	6.79	
Nicaragua.					
Bluefields	92	74	82.6	15.27	
West Indies.					
Basseterre, St. Kitts	85	68	78.3	8.00	
Hamilton, Ber	80	57	70.4	.....	

Late reports for April, 1906.

Alabama.	°	°	°	*Ins.*	*Ins.*
Lucy	94	.....	.....	1.23	
Alaska.					
Chestochena	69	15	34.6	T.	
Copper Center	59	−17	28.8	0.36	3.0
Fairbanks	58	−12	25.5	0.50	5.0
Fort Egbert	54	11	24.6	0.60	
Fort Gibbon	55	−15	23.8	T.	T.
Kenai	61	− 5	35.7	0.08	3.0
Ketchemstock	54	−25	23.0	0.27	5.0
Loring	59	26	41.9	24.52	4.2
Orca	62[b]	22	38.0[c]	7.54	17.0
Rampart	65	−21	21.1	0.04	0.5
Skagway	56	28	41.4	3.55	.....

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alaska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Sunrise	54	6	34.4	1.17	3.8
Teikhill	53	−10	31.4	0.58	5.5
Udakta	48	22	35.2	3.07	
California.					
Azusa	97	30	57.8	1.34	
Bodie	64	8	33.3	1.85	21.0
Bowman Dam	.....	.....	.....	1.93	4.0
Jolan	.....	.....	.....	0.70	
Kernville	.....	.....	.....	0.69	
Livermore	90	36	56.8	0.95	
Newman	90	36	59.6	1.18	
North Fork	....	.....	.....	4.41	
Priest Valley	.....	.....	.....	1.50	
Redding	87	35	60.4	2.68	
Redland	92	32	58.6	1.30	
Salton	95	30	62.1	0.00	
San Miguel Island	.....	.....	.....	0.30	
Santa Clara College	94	36	56.6	0.93	
Sisquoc Ranch	.....	.....	.....	0.52	
Sneddens Ranch	.....	.....	.....	1.25	
Willets	88	27	56.2	2.63	
West Saticoy	.....	.....	.....	0.30	
Colorado.					
Dunkley	61	15	37.4	3.92	26.5
Idaho.					
Riddle	72	16	43.0	3.17	17.0
Kansas.					
Ness City	.....	.....	.....	2.55	
Nebraska.					
Bloomfield	90	25	52.4	4.04	T.
New Hampshire.					
Bretton Woods	.....	.....	.....	1.30	
North Carolina.					
Brewers	87[a]	28[a]	58.2[a]	1.81	
Lumberton	92	32	63.1	0.93	
Ohio.					
Portsmouth	87	29	57.6	1.04	
Oklahoma.					
Chattanooga	88	43[f]	65.8[c]	2.66	
Frederick	89	39	62.6	2.20	
Helena	88	36	61.3	2.44	
Tennessee.					
Watertown	89	26	60.8	3.65	
Texas.					
Dalhart	85	30	56.4	3.40	
Kent	92	38	61.1	0.01	
Utah.					
Loa	76	17	41.8	.....	.....
Washington.					
Stehekin	79	29	51.4	0.25	
Porto Rico.					
Isabel	89	68	79.0	5.64	
La Carmelita	85	60	72.3	3.92	
Vieques	90	69	78.8	1.10	
Yabucoa	.....	.....	.....	0.92	

EXPLANATION OF SIGNS.

° Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.
[2] Mean of 8 a. m. + 8 p. m. + 2.
[3] Mean of 7 a. m. + 7 p. m. + 2.
[4] Mean of 6 a. m. + 6 p. m. + 2.
[5] Mean of 7 a. m. + 2 p. m. + 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "[a]" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

February, 1906, Mississippi, Fayette, make mean temperature 46.8 instead of 47.0.

TABLE III.—*Wind resultants, from observations at 8 a. m. and 8 p. m., daily, during the month of May, 1906.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	16	25	6	24	s. 61 w.	18
Portland, Me	19	18	13	24	n. 85 w.	11
Concord, N. H.†	13	8	12	10	n. 14 e.	8
Burlington, Vt.†	11	16	1	9	s. 58 w.	9
Northfield, Vt	23	30	9	14	s. 36 w.	9
Boston, Mass	20	15	11	29	n. 74 w.	19
Nantucket, Mass	12	30	7	27	s. 48 w.	27
Block Island, R. I	13	29	9	28	s. 50 w.	25
Providence, R. I	18	21	11	25	s. 78 w.	14
Hartford, Conn	20	29	7	16	s. 45 w.	13
New Haven, Conn	20	29	7	22	s. 39 w.	18
Middle Atlantic States.						
Albany, N. Y	18	27	5	21	s. 61 w.	18
Binghamton, N. Y.†	11	5	10	10	n.	6
New York, N. Y	16	25	12	24	s. 53 w.	15
Harrisburg, Pa	16	19	16	23	s. 67 w.	8
Philadelphia, Pa	22	21	8	28	n. 87 w.	20
Scranton, Pa	19	24	9	29	s. 76 w.	21
Atlantic City, N. J	14	26	11	26	s. 51 w.	19
Cape May, N. J	16	30	14	16	s. 8 w.	14
Baltimore, Md	18	22	8	26	s. 77 w.	18
Washington, D. C	19	27	8	18	s. 51 w.	13
Lynchburg, Va	14	25	21	17	s. 20 e.	12
Mount Weather, Va	19	19	12	29	w.	17
Norfolk, Va	15	30	13	13	s.	15
Richmond, Va	16	29	17	12	s. 21 e.	14
Wytheville, Va	11	11	14	37	w.	23
South Atlantic States.						
Asheville, N. C	23	22	21	19	n. 63 e.	2
Charlotte, N. C	13	24	20	18	s. 10 e.	11
Hatteras, N. C	12	25	17	20	s. 13 w.	13
Raleigh, N. C	17	22	13	22	s. 61 w.	10
Wilmington, N. C	14	22	16	23	s. 41 w.	11
Charleston, S. C	12	18	25	15	s. 61 e.	12
Columbia, S. C	15	22	21	19	s. 16 e.	7
Augusta, Ga	14	22	26	16	s. 51 e.	13
Savannah, Ga	12	19	21	21	s.	7
Jacksonville, Fla	18	17	28	15	n. 86 e.	13
Florida Peninsula.						
Jupiter, Fla	9	24	20	21	s. 4 w.	15
Key West, Fla	16	14	28	17	n. 80 e.	11
Tampa, Fla	24	10	24	20	n. 16 e.	15
Eastern Gulf States.						
Atlanta, Ga	15	18	19	24	s. 59 w.	6
Macon, Ga.†	11	9	9	7	n. 45 e.	3
Thomasville, Ga†	10	10	12	9	c.	3
Pensacola, Fla.†	11	7	12	8	n. 45 e.	6
Anniston, Ala.†	13	26	24	9	s. 62 e.	17
Birmingham, Ala.†	11	6	12	10	n. 22 e.	5
Mobile, Ala	26	26	10	12	w.	2
Montgomery, Ala	22	18	22	16	n. 56 e.	7
Meridian, Miss.†	10	7	13	7	n. 63 e.	7
Vicksburg, Miss	12	25	31	8	s. 61 e.	26
New Orleans, La	19	26	26	10	s. 66 e.	18
Western Gulf States.						
Shreveport, La	13	33	26	7	s. 44 e.	28
Bentonville, Ark.†	4	20	8	2	s. 21 e.	17
Fort Smith, Ark	9	19	37	4	s. 73 e.	34
Little Rock, Ark	18	29	29	10	s. 42 e.	15
Corpus Christi, Tex	6	32	38	2	s. 54 e.	44
Fort Worth, Tex	10	35	23	8	s. 31 e.	29
Galveston, Tex	5	41	31	6	s. 35 e.	44
Palestine, Tex	14	31	25	7	s. 47 e.	25
San Antonio, Tex	10	33	34	2	s. 54 e.	39
Taylor, Tex.†	7	15	15	3	s. 56 e.	14
Ohio Valley and Tennessee.						
Chattanooga, Tenn	15	18	15	25	s. 73 w.	10
Knoxville, Tenn	25	15	17	22	n. 27 w.	11
Memphis, Tenn	18	29	20	8	s. 47 e.	16
Nashville, Tenn	19	16	14	26	n. 76 w.	12
Lexington, Ky.†	7	16	10	8	s. 13 e.	9
Louisville, Ky	18	30	11	13	s. 9 w.	12
Evansville, Ind.†	7	16	6	4	s. 13 e.	9
Indianapolis, Ind	16	30	11	21	s. 36 w.	17
Cincinnati, Ohio	10	24	19	23	s. 16 w.	15
Columbus, Ohio	17	22	16	19	s. 31 w.	6
Pittsburg, Pa	20	24	7	29	s. 80 w.	22
Parkersburg, W. Va	17	23	14	21	s. 49 w.	9
Elkins, W. Va	16	18	10	27	s. 83 w.	17
Lower Lake Region.						
Buffalo, N. Y	15	28	10	24	s. 47 w.	19
Oswego, N. Y	13	25	10	24	s. 49 w.	18
Rochester, N. Y	13	21	14	31	s. 65 w.	19
Syracuse, N. Y	15	24	8	28	s. 66 w.	22
Erie, Pa	15	18	14	31	s. 80 w.	17
Cleveland, Ohio	23	22	16	17	n. 45 w.	1
Sandusky, Ohio†	6	12	8	14	s. 45 w.	8
Toledo, Ohio	15	22	17	24	s. 45 w.	10
Detroit, Mich	13	21	18	23	s. 32 w.	9
Upper Lake Region.						
Alpena, Mich	22	17	22	17	n. 45 e.	7
Escanaba, Mich	27	19	17	10	n. 41 e.	11
Grand Haven, Mich	17	20	18	23	s. 59 w.	6
Grand Rapids, Mich	16	17	17	28	s. 85 w.	11
Houghton, Mich.†	7	5	19	5	n. 82 e.	14
Marquette, Mich	10	19	13	10	s. 18 e.	10
Port Huron, Mich	20	23	14	18	s. 53 w.	5
Sault Ste. Marie, Mich	17	10	26	22	n. 30 e.	8
Chicago, Ill	17	25	15	22	s. 41 w.	11
Milwaukee, Wis	20	15	20	22	n. 22 w.	5
Green Bay, Wis	16	21	24	16	s. 58 e.	9
Duluth, Minn	35	5	28	17	n. 20 e.	32
North Dakota.						
Moorhead, Minn	26	17	27	11	n. 61 e.	18
Bismarck, N. Dak	25	8	27	16	n. 33 e.	20
Devils Lake, N. Dak	25	8	30	12	n. 47 e.	25
Williston, N. Dak						
Upper Mississippi Valley.						
Minneapolis, Minn.*	11	6	8	12	n. 39 w.	6
St. Paul, Minn	21	20	20	17	n. 72 e.	3
La Crosse, Wis.†	6	16	5	7	s. 11 w.	10
Madison, Wis	11	26	14	23	s. 31 w.	18
Charles City, Iowa	17	25	20	17	s. 21 e.	8
Davenport, Iowa	18	21	15	25	s. 73 w.	10
Des Moines, Iowa	17	31	10	17	s. 27 w.	16
Dubuque, Iowa	11	25	16	21	s. 20 w.	15
Keokuk, Iowa	15	31	10	23	s. 39 w.	21
Cairo, Ill	14	35	15	14	s. 3 e.	21
La Salle, Ill.†	6	10	9	12	s. 37 w.	5
Peoria, Ill	15	32	12	15	s. 10 w.	17
Springfield, Ill	11	16	11	18	s. 54 w.	9
Hannibal, Mo.†	5	13	5	13	s. 45 w.	11
St. Louis, Mo	11	33	17	13	s. 10 e.	22
Missouri Valley.						
Columbia, Mo.*	5	19	6	9	s. 12 w.	14
Kansas City, Mo	12	36	15	12	s. 7 e.	24
Springfield, Mo	12	34	16	13	s. 8 e.	22
Iola, Kans.†	6	17	8	9	s. 5 w.	11
Topeka, Kans.*	6	14	7	7	s.	8
Lincoln, Nebr	18	35	9	9	s.	17
Omaha, Nebr	17	33	11	15	s. 14 w.	16
Valentine, Nebr	20	16	16	21	n. 51 w.	6
Sioux City, Iowa †	7	16	9	6	s. 18 e.	10
Pierre, S. Dak	20	19	23	19	n. 76 e.	4
Huron, S. Dak	16	22	22	15	s. 49 e.	9
Yankton, S. Dak. †	4	13	9	12	s. 18 w.	10
Northern Slope.						
Havre, Mont	22	9	21	23	n. 9 w.	13
Miles City, Mont	25	13	22	18	n. 18 e.	13
Helena, Mont	20	15	7	35	n. 80 w.	28
Kalispell, Mont	18	5	15	32	n. 52 w.	22
Rapid City, S. Dak	23	12	19	19	n.	11
Cheyenne, Wyo	21	21	10	24	w.	14
Lander, Wyo	20	17	15	22	n. 67 w.	8
Yellowstone Park, Wyo	19	31	1	26	s. 64 w.	28
North Platte, Nebr	18	22	15	21	s. 56 w.	7
Middle Slope.						
Denver, Colo	25	24	15	10	n. 79 e.	5
Pueblo, Colo	23	15	22	20	n. 14 e.	8
Concordia, Kans	13	32	13	14	s. 3 w.	19
Dodge, Kans	11	31	26	8	s. 42 e.	27
Wichita, Kans	17	30	20	8	s. 43 e.	18
Oklahoma, Okla	12	42	10	3	s. 13 e.	31
Southern Slope.						
Abilene, Tex	9	40	17	6	s. 20 e.	33
Amarillo, Tex	7	35	23	11	s. 23 e.	30
Del Rio, Tex†	5	12	21	1	s. 71 e.	21
Roswell, N. Mex.	16	21	10	29	s. 61 w.	10
Southern Plateau.						
El Paso, Tex	14	3	14	40	n. 67 w.	28
Santa Fe, N. Mex	19	19	19	23	w.	4
Flagstaff, Ariz	15	21	4	35	s. 79 w.	32
Phoenix, Ariz	14	6	26	26	n.	8
Yuma, Ariz	6	20	7	41	s. 68 w.	37
Independence, Cal	23	19	13	25	n. 72 w.	13
Middle Plateau.						
Reno, Nev	9	14	4	43	s. 83 w.	39
Winnemucca, Nev	21	17	14	28	n. 74 w.	15
Modena, Utah	8	21	7	41	s. 69 w.	36
Salt Lake City, Utah	16	24	26	13	s. 58 e.	15
Durango, Colo	30	10	6	31	n. 51 w.	32
Grand Junction, Colo	18	17	24	17	n. 82 e.	7
Northern Plateau.						
Baker City, Oreg	21	28	14	12	s. 16 e.	7
Boise, Idaho	22	16	19	22	n. 27 w.	7
Lewiston, Idaho†	3	7	17	9	s. 63 e.	9
Pocatello, Idaho	3	32	24	22	s. 4 e.	29
Spokane, Wash	9	26	13	24	s. 33 w.	20
Walla Walla, Wash	5	38	13	14	s. 2 w.	33
North Pacific Coast Region.						
North Head, Wash	21	19	11	29	n. 84 w.	18
Port Crescent, Wash.*	15	4	5	19	n. 52 w.	18
Seattle, Wash	17	24	18	18	s.	7
Tacoma, Wash.†	25	19	3	24	n. 74 w.	22
Tatoosh Island, Wash	1	19	15	33	s. 45 w.	26
Portland, Oreg	16	21	13	28	s. 72 w.	16
Roseburg, Oreg	22	22	11	19	w.	8
Middle Pacific Coast Region.						
Eureka, Cal	21	25	7	22	s. 75 w.	16
Mount Tamalpais, Cal	19	13	2	44	n. 86 w.	42
Red Bluff, Cal	16	32	18	14	s. 14 e.	16
Sacramento, Cal	6	44	16	9	s. 10 e.	39
San Francisco, Cal	9	17	2	44	s. 79 w.	43
San Jose, Cal.†						
Southeast Farallon, Cal.*	13	7	0	22	n. 75 w.	23
South Pacific Coast Region.						
Fresno, Cal	43	6	4	23	n. 27 w.	42
Los Angeles, Cal	5	23	15	33	s. 45 w.	26
San Diego, Cal	17	15	4	40	n. 87 w.	36
San Luis Obispo, Cal	23	12	3	36	n. 72 w.	35
West Indies						
Grand Turk, W. I.†	0	16	22	0	s. 54 e.	27
Hamilton, Bermuda	13	30	18	13	s. 10 e.	17
San Juan, Porto Rico	8	15	49	1	s. 82 e.	48

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour, during May, 1906, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	2			0.49									0.36								
Alpena, Mich.	16–17			0.34														0.28			
Amarillo, Tex.	10–11			0.57														0.53			
Asheville, N. C.	2			0.35									0.30								
Atlanta, Ga.	25–26	3:32 p. m.	D. N.	2.00	9:15 p. m.	10:45 p. m.	0.37	0.09	0.14	0.18	0.23	0.27	0.36	0.45	0.52	0.57	0.61	0.78	1.08	1.26	
Atlantic City, N. J.	31	5:54 p. m.	8:50 p. m.	1.38	6:16 p. m.	6:26 p. m.	0.01	0.83	1.19												
Augusta, Ga.	26	2:25 p. m.	5:50 p. m.	2.02	3:02 p. m.	4:07 p. m	0.01	0.11	0.19	0.46	0.71	0.79	0.85	0.96	1.13	1.21	1.39	1.73	1.88		
Baltimore, Md.	5	4:12 p. m.	6:10 p. m.	1.16	4:29 p. m.	5:27 p. m.	0.03	0.15	0.34	0.36	0.37	0.63	0.77	0.79	0.81	0.88	0.95	1.06			
Binghamton, N. Y.	17			0.67														0.48			
Birmingham, Ala.	18	11:31 a. m.	12:55 p. m.	1.44	11:31 a. m.	12:01 p. m.	0.00	0.13	0.38	0.63	0.98	1.21	1.39								
Bismarck, N. Dak.	24			0.95														0.43			
Block Island, R. I.	28–29			3.27														0.49			
Boise, Idaho.	26			0.16														0.15			
Boston, Mass.	27–29			3.56														0.60			
Buffalo, N. Y.	26			0.20														0.18			
Cairo, Ill.	1–2			0.30														0.18			
Charles City, Iowa.	21	11:57 a. m.	2:45 p. m.	0.97	12:43 p. m.	1:26 p. m.	0.07	0.20	0.45	0.46	0.47	0.50	0.55	0.60	0.69	0.77					
Charleston, S. C.	23–24			1.13														0.47			
Charlotte, N. C.	4	3:10 p. m.	8:25 p. m.	1.19	3:39 p. m.	4:12 p. m.	0.17	0.06	0.14	0.28	0.45	0.57	0.75	0.77							
Chattanooga, Tenn.	25–26			1.00																	
Cheyenne, Wyo.	23–24			0.53														0.17			
Chicago, Ill.	1–2			1.26														0.46			
Cincinnati, Ohio.	2			0.36														0.33			
Cleveland, Ohio.	4			0.54														0.35			
Columbia, Mo.	30–31	7:04 p. m.	4:35 a. m.	0.82	12:07 a. m.	12:22 a. m.	0.20	0.31	0.39	0.47											
Columbia, S. C.	6–7			1.14														0.38			
Columbus, Ohio.	22			0.58						0.39											
Concord, N. H.	27–29			3.67														0.35			
Corpus Christi, Tex.	26	8:46 a. m.	10:46 a. m.	1.14	9:46 a. m.	10:21 a. m.	0.06	0.10	0.21	0.30	0.57	0.85	0.99	1.04							
Davenport, Iowa.	10–11			0.66														0.31			
Del Rio	18	8:03 p. m.	9:15 p. m.	0.99	8:04 p. m.	8:24 p. m.	0.01	0.29	0.46	0.62	0.78										
Denver, Colo.	29			0.19						0.19											
Des Moines, Iowa.	15			0.63														0.46			
Detroit, Mich.	13–14			0.83														0.37			
Devils Lake	17	D. N.	5:49 a. m.	0.88	4:36 a. m.	5:25 a. m.	0.04	0.13	0.21	0.24	0.35	0.44	0.48	0.57	0.65	0.75	0.80				
Dodge, Kans.	19			0.42						0.37											
Dubuque, Iowa.	1			0.77														0.34			
Duluth, Minn.	17			0.48						0.44											
Eastport, Me.	27–29			2.85														0.26			
Elkins, W. Va.	27			0.73						0.40											
Erie, Pa.	4			0.33									0.19								
Escanaba, Mich.	1–2			0.53									0.17								
Evansville, Ind.	31			0.37					0.34												
Fort Smith, Ark.	2–3	8:45 p. m.	3:00 a. m.	2.21	12:12 a. m.	12:55 a. m.	0.38	0.16	0.23	0.33	0.45	0.54	0.76	0.83	0.92	0.97					
Fort Worth, Tex.	2	4:20 p. m.	6:40 p. m.	1.77	4:36 p. m.	5:36 p. m.	0.03	0.12	0.15	0.18	0.21	0.34	0.62	1.09	1.21	1.34	1.56	1.73			
Do.	15	9:35 a. m.	3:05 p. m.	2.11	11:34 a. m.	12:11 p. m.	0.75	0.07	0.20	0.42	0.56	0.74	0.89	1.09	1.14						
Galveston, Tex.	26			0.10									0.05								
Grand Rapids, Mich.	26–27			0.95														0.44			
Green Bay, Wis.	16			0.52														0.44			
Hannibal, Mo.	26	6:01 p. m.	9:20 p. m.	2.16	7:10 p. m.	8:07 p. m.	0.02	0.13	0.34	0.77	1.23	1.36	1.36	1.36	1.57	1.77	1.96	2.07			
Harrisburg, Pa.	26–27			0.43														0.19			
Hartford, Conn.	27–29			3.95														0.49			
Hatteras, N. C.	3			0.13									0.13								
Huron, S. Dak.	13–14			0.51														0.40			
Indianapolis, Ind.	27–28			0.88														0.52			
Iola, Kans.	30	8:20 p. m.	12:00 mid.	2.10	9:08 p. m.	9:23 p. m.	0.07	0.16	0.32	0.50											
					10:23 p. m.	11:14 p. m.	0.86	0.07	0.18	0.37	0.54	0.58	0.68	0.70	0.83	0.94	1.06				
					1:09 p. m.	1:59 p. m.	2.87	0.19	0.39	0.52	0.63	0.79	0.95	1.10	1.22	1.32	1.42				
Jacksonville, Fla.	21–22	7:39 p. m.	D. N.	7.10	1:59 p. m.	2:49 p. m.		1.55	1.63	1.85	2.07	2.19	2.42	2.51	2.54	2.56	2.60				
					2:49 p. m.	3:54 p. m.		2.64	2.72	2.77	2.86	3.02	3.21	3.34	3.42	3.54	3.60	3.91			
Jupiter, Fla.	22	6:10 a. m.	7:25 a. m.	1.77	6:29 a. m.	7:17 a. m.	0.12	0.20	0.39	0.55	0.65	0.75	0.98	1.30	1.54	1.60	1.65				
Do.	30	12:05 a. m.	1:30 a. m.	1.04	12:32 a. m.	1:01 a. m.	0.12	0.07	0.28	0.56	0.73	0.88	0.91								
Kansas City, Mo.	17	7:43 p. m.	9:30 p. m.	1.21	8:01 p. m.	8:54 p. m.	0.01	0.18	0.30	0.38	0.52	0.68	0.76	0.89	1.00	1.07	1.12	1.19			
Key West, Fla.	21	7:55 a. m.	3:50 p. m.	3.17	12:42 p. m.	2:12 p. m.	0.63	0.09	0.13	0.16	0.19	0.47	0.78	0.93	1.00	1.11	1.30	1.61	2.20	2.38	
Knoxville, Tenn.	21			0.55									0.51								
La Crosse, Wis.	26–27			1.59														0.50			
La Salle, Ill.	18			0.29														0.23			
Lexington, Ky.	31			0.50							0.42										
Lincoln, Nebr.	29			0.69									0.65								
Little Rock, Ark.	2–3	12:03 p. m.	6:05 a. m.	2.86	1:51 p. m.	2:05 p. m.	0.09	0.21	0.52	0.66											
Los Angeles, Cal.	27			0.57														0.19			
Louisville, Ky.	31	3:00 p. m.	7:15 p. m.	1.10	3:42 p. m.	4:01 p. m.	0.04	0.32	0.60	0.78	0.85										
Lynchburg, Va.	6–7	8:50 p. m.	3:50 a. m.	1.29	9:33 p. m.	10:13 p. m.	0.10	0.05	0.11	0.22	0.29	0.34	0.51	0.62	0.69						
Macon, Ga.	6–7			0.93														0.21			
Madison, Wis.	26–27			1.14														0.42			
Memphis, Tenn.	26–27			0.80						0.53											
Meridian, Miss.	4	2:40 p. m.	11:30 p. m.	2.25	3:16 p. m.	3:43 p. m.	0.02	0.11	0.18	0.33	0.76	0.97	1.12								
Do.	18	10:55 a. m.	1:35 p. m.	0.95	11:15 a. m.	11:49 a. m.	0.05	0.05	0.15	0.39	0.59	0.70	0.80	0.85							
Milwaukee, Wis.	13–14			1.01														0.61			
Minneapolis, Minn.	12–13	9:35 p. m.	D. N.	1.65	9:43 p. m.	10:43 p. m.	0.01	0.13	0.28	0.40	0.57	0.70	0.80	0.86	0.91	0.98	1.03	1.15			
Montgomery, Ala.	3			0.38						0.33											
Mount Weather, Va.	26–28			1.55														0.44			
Nantucket, Mass.	2			0.35														0.28			
Nashville, Tenn.	2			0.49						0.46											
New Haven, Conn.	27–28			2.11						0.39											
New Orleans, La.	7			0.54									0.27								
New York, N. Y.	27	10:35 a. m.	12:30 p. m.	1.06	10:58 a. m.	11:15 a. m.	T.	0.05	0.29	0.64	0.72										
Norfolk, Va.	28	D. N.	2:50 p. m.	2.92	8:50 a. m.	9:31 a. m.	0.26	0.06	0.13	0.17	0.41	0.74	1.23	1.53	1.61						
					1:16 p. m.	1:46 p. m.	2.08	0.14	0.24	0.38	0.52	0.60	0.69								
Northfield, Vt.	24	1:48 p. m.	2:17 p. m.	0.78	1:52 p. m.	2:09 p. m.	0.01	0.35	0.55	0.73	0.77										
North Head, Wash.	21–22			0.29									0.19								
Oklahoma, Okla.	14			0.88														0.42			
Omaha, Nebr.	22			0.61										0.55							
Palestine, Tex.	3			0.38					0.37												
Parkersburg, W. Va.	26			0.60														0.36			
Pensacola, Fla.	7			0.51									0.35								
Peoria, Ill.	18	4:25 a. m.	6:00 a. m.	1.01	4:27 a. m.	5:07 a. m.	0.01	0.10	0.16	0.22	0.39	0.64	0.70	0.85	0.91						
Philadelphia, Pa.	5	6:20 p. m.	9:10 p. m.	0.77	6:38 p. m.	7:04 p. m.	0.01	0.11	0.26	0.37	0.52	0.63	0.67								
Do.	28–29	D. N.	D. N.	1.74	1:36 p. m.	2:05 p. m.	0.20	0.06	0.17	0.35	0.47	0.58	0.65								
Pittsburg, Pa.	28			0.44														0.29			

TABLE IV.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Portland, Me	27-29			3.36														0.18			
Portland, Oreg	14			0.60									0.12								
Pueblo, Colo	23			0.49														0.37			
Raleigh, N. C	27-28			1.07														0.24			
Richmond, Va	26	6:14 p. m.	7:02 p. m.	1.09	6:16 p. m.	6:42 p. m.	0.01	0.10	0.34	0.51	0.73	1.01	1.04								
Rochester, N. Y	13			0.58														0.15			
Sacramento, Cal	27			1.02														0.37			
St. Louis, Mo	30-31			1.72					0.39												
St. Paul, Minn	21	11:15 a. m.	12:40 p. m.	0.57	12:10 p. m.	12:22 p. m.	0.03	0.24	0.38	0.47											
		4:45 p. m.	9:30 p. m.	1.71	4:55 p. m.	5:05 p. m.	0.01	0.52	0.78												
Salt Lake City, Utah	27-28			1.06														0.32			
San Antonio, Tex	22			0.28														0.20			
San Diego, Cal	28			0.28														0.15			
Sandusky, Ohio	4			0.56							0.45										
San Francisco, Cal	27-28			1.54														*			
Savannah, Ga	22-24			2.12														*			
Scranton, Pa	17			0.53														0.35			
Seattle, Wash	13-14			0.73														0.16			
Shreveport, La	3	10:50 a. m.	1:40 p. m.	1.64	11:51 a. m.	12:40 p. m.	0.04	0.10	0.25	0.32	0.48	0.69	0.85	1.15	1.42	1.47	1.52				
Spokane, Wash	25-26			1.54														0.29			
Springfield, Ill	1			0.73								0.53									
Springfield, Mo	31	7:20 a. m.	11:35 a. m.	1.86	9:45 a. m.	10:07 a. m.	0.34	0.10	0.53	1.12	1.40	1.45									
Syracuse, N. Y	2			0.86														0.26			
Tampa, Fla	22	2:30 p. m.	4:45 p. m.	1.38	2:32 p. m.	3:12 p. m.	0.01	0.53	0.75	0.92	1.00	1.09	1.15	1.20	1.28						
Taylor, Tex	23			0.60							0.46										
Toledo, Ohio	26	10:44 a. m.	2:28 p. m.	0.92	1:36 p. m.	2:04 p. m.	0.04	0.07	0.13	0.39	0.56	0.69	0.82								
Topeka, Kans	29			0.22									0.21								
Valentine, Nebr	23	12:55 p. m.	3:10 p. m.	1.22	1:00 p. m.	1:28 p. m.	0.01	0.39	0.66	0.74	0.81	0.93	0.98								
Vicksburg, Miss	3	12:54 p. m.	2:17 p. m.	0.62	1:14 p. m.	1:48 p. m.	0.04	0.29	0.38	0.40	0.41	0.42	0.49	0.55							
Washington, D. C	31	5:05 p. m.	6:10 p. m.	0.49	5:13 p. m.	5:20 p. m.	T.	0.35	0.45												
Wichita, Kans	22	1:05 p. m.	2:45 p. m.	1.09	1:36 p. m.	2:29 p. m.	0.23	0.21	0.22	0.23	0.32	0.53	0.65								
Williston, N. Dak																					
Wilmington, N. C	3			0.37				0.33													
Wytheville, Va	1			0.47									0.32								
Yankton, S. Dak	24-25	5:02 p. m.	D. N.	1.88	6:27 p. m.	7:08 p. m.	0.15	0.33	0.62	0.71	0.72	0.90	1.01	1.07	1.25	1.32					
San Juan, Porto Rico	26			0.25														0.23			

* Self-register not working

TABLE V.—*Data furnished by the Canadian Meteorological Service, May, 1906.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Pressure, in inches. Sea level, reduced to mean of 24 hours.	Pressure, in inches. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Total snowfall.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F	29.74	29.88	—.10	44.4	+ 1.5	52.3	36.5	6.05	+2.39	T.
Sydney, C. B. I	29.87	29.91	—.06	45.0	— 0.2	52.5	37.5	5.80	+2.03	
Halifax, N. S	29.83	29.94	—.04	49.8	+ 1.4	58.5	41.1	6.30	+1.94	
Grand Manan, N. B	29.85	29.90	—.07	47.9	0.0	54.9	41.0	7.21	+3.60	
Yarmouth, N. S	29.87	29.94	—.04	47.8	+ 0.2	54.2	41.4	6.23	+2.43	
Charlottetown, P. E. I	29.87	29.91	—.05	46.8	— 0.1	54.0	39.7	5.85	+2.94	
Chatham, N. B	29.86	29.88	—.07	50.0	+ 1.5	61.0	39.1	2.99	—0.22	
Father Point, Que	29.89	29.91	—.02	43.8	— 0.2	51.1	36.4	2.47	—0.11	
Quebec, Que	29.59	29.91	—.05	49.2	— 0.7	58.9	39.4	2.91	— 0.17	0.2
Montreal, Que	29.72	29.93	—.01	52.7	— 2.0	61.2	44.3	2.37	—0.58	
Rockliffe, Ont	29.33	29.94	+.01	49.8	— 2.5	61.2	38.5	2.44	—0.07	
Ottawa, Ont	29.58	29.90	—.04	53.9	— 1.0	64.6	43.2	1.60	—0.99	
Kingston, Ont	29.66	29.97	+.01	51.8	— 1.1	60.7	42.9	1.63	—1.05	
Toronto, Ont	29.59	29.97	—.01	54.2	+ 1.0	64.2	44.3	2.69	—0.35	
White River, Ont	28.63	29.95	.00	44.8	— 0.9	57.2	32.4	2.54	+0.59	
Port Stanley, Ont	29.34	29.98	+.01	53.1	0.0	62.3	43.9	1.86	—1.32	
Saugeen, Ont	29.28	29.99	+.03	51.4	+ 0.7	61.2	41.6	2.08	—0.36	T.
Parry Sound, Ont	29.27	29.97	+.02	51.2	+ 0.1	62.0	40.4	1.53	—1.40	
Port Arthur, Ont	29.27	29.98	+.02	43.8	— 2.1	52.3	35.3	2.97	+0.82	
Winnipeg, Man	29.13	29.96	.00	48.9	— 2.7	61.6	36.2	2.97	+0.69	0.1
Minnedosa, Man	28.14	29.95	—.01	48.1	— 0.3	59.5	36.7	3.98	+2.53	T
Qu'Appelle, Assin	27.68	29.92	—.02	48.6	— 1.2	59.7	37.5	3.27	+1.62	8.2
Medicine Hat, Assin	27.59	29.87	—.02	52.1	— 2.0	62.8	41.4	4.37	+3.06	
Swift Current, Assin	27.36	29.93	+.01	49.9	— 0.8	60.3	39.5	3.08	+1.32	0.4
Calgary, Alberta	26.39	29.92	+.04	46.4	— 2.6	57.7	35.2	6.96	+5.19	8.2
Banff, Alberta	25.33	29.91	+.03	44.1	— 2.9	55.1	33.1	2.98	+0.94	1.1
Edmonton, Alberta	27.63	29.91	+.03	48.0	— 2.8	59.5	36.5	1.45	—0.10	1.4
Prince Albert, Sask	28.38	29.94	—.01	47.7	+ 0.1	60.1	35.3	1.20	—0.06	T.
Battleford, Sask	28.25	29.98	+.06	49.0	— 2.0	60.6	37.4	0.37	—1.25	
Kamloops, B. C	28.62	29.83	—.06	59.2	+ 0.1	71.2	47.2	1.79	+0.55	
Victoria, B. C	29.88	29.98	—.02	54.5	+ 2.0	62.7	46.3	1.81	+0.33	
Barkerville, B. C	25.63	29.92	+.08	47.1	+ 1.6	60.0	34.3	1.00	—1.52	
Hamilton, Bermuda	29.99	30.15	+.09	69.2	— 0.2	73.6	64.8	2.32	—2.34	
Dawson, Yukon										

TABLE VI.—*Heights of rivers referred to zeros of gages, May, 1906.*

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Milk River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Havre, Mont	237	9	6.6	31	3.3	9-15	3.7	3.3
Yellowstone River.								
Billings, Mont	330	8	5.4	14,25	1.2	3	3.5	4.2
Cheyenne River.								
Rousseau, S. Dak	7	9	7.3	30	0.2	23	2.5	7.1
James River.								
Lamoure, N. Dak	330	14	— 0.5	31	— 1.6	8-12	—1.2	1.1
Huron, S. Dak	139	9	3.8	31	1.7	18,23-25	2.4	2.1
Big Blue River.								
Beatrice, Nebr	92	14	6.9	5	2.3	20,21,23-25	3.5	4.6
Blue Rapids, Kans	47	14	9.9	6	5.3	27,28	6.7	4.6
Republican River.								
Clay Center, Kans	42	18	10.5	5	6.9	23,31	8.0	3.6
Solomon River.								
Beloit, Kans	75	16	18.0	22	1.0	20	2.7	17.0
Smoky Hill-Kansas River.								
Lindsborg, Kans	341	20	2.2	24	1.2	13, 22	1.6	1.0
Abilene, Kans	277	22	9.0	26	0.9	22	2.2	8.1
Manhattan, Kans	116	18	7.2	6	3.9	22	5.1	3.3
Topeka, Kans	87	21	9.3	5,6	7.6	21,22	8.3	1.7
Osage River.								
Bagnell, Mo	70	28	5.4	5	2.2	30,31	3.0	3.2
Gasconade River.								
Arlington, Mo	98	16	1.2	7-9	0.0	28,30	0.5	1.2
Missouri River.								
Townsend, Mont	2,504	11	6.2	29	4.6	9,10	5.1	1.6
Fort Benton, Mont	2,285	12	4.1	31	2.2	1-5	2.7	1.9
Wolfpoint, Mont	1,952	17	5.0	25	2.4	1	3.2	2.6
Bismarck, N. Dak	1,309	14	8.4	29,30	0.9	1	3.3	7.5
Pierre, S. Dak	1,114	14	8.1	31	1.6	1	3.6	6.5
Sioux City, Iowa	784	19	12.1	31	7.1	10, 11	8.2	5.0
Blair, Nebr	705	15	10.8	30	6.5	11-17	7.5	4.3
Omaha, Nebr	669	18	12.4	31	8.9	17	9.8	3.5
Plattsmouth, Nebr	641	17	7.0	30	4.1	17, 19, 20	5.2	2.9
St. Joseph, Mo	481	10	7.6	3	3.7	21	4.9	3.9
Kansas City, Mo	388	21	14.9	4	9.6	22	11.2	5.3
Glasgow, Mo	231	18	12.0	5	7.4	23	8.9	4.6
Boonville, Mo	199	20	13.6	6	9.4	22-25	10.6	4.2
Hermann, Mo	103	24	13.1	7	8.6	23-26,29,30	9.9	5.5
Minnesota River.								
Mankato, Minn	127	18	7.8	31	5.1	16, 17, 21	5.5	2.7
St. Croix River.								
Stillwater, Minn	23	11	12.6	31	8.9	16,17,19-21	9.9	3.7
Chippewa River.								
Chippewa Falls, Wis	75	16	6.8	29	1.8	12, 22	4.1	5.0
Red Cedar River.								
Cedar Rapids, Iowa	77	14	6.4	20	3.8	16	4.6	2.6
Des Moines River.								
Des Moines, Iowa	205	19	6.8	5	3.6	26	4.8	3.2
Illinois River.								
La Salle, Ill	197	18	15.3	1	12.5	24	13.6	2.8
Peoria, Ill	135	14	12.8	1	9.3	30,31	10.8	3.5
Beardstown, Ill	70	12	12.7	1	9.2	31	10.7	3.5
Clarion River.								
Clarion, Pa	32	10	2.8	10,28	1.6	26	2.2	1.2
Conemaugh River.								
Johnstown, Pa	64	7	2.2	3,29-31	0.6	25,26	1.1	1.6
Allegheny River								
Warren, Pa	177	14	3.2	3,6	1.3	18, 26-30	2.0	1.9
Franklin, Pa	114	15	4.3	6	1.7	26	2.6	2.6
Parker, Pa	73	20	3.9	7	1.6	24, 26	2.4	2.3
Freeport, Pa	29	20	6.8	7	2.9	25	4.7	3.9
Springdale, Pa	17	27	10.5	7	7.5	27	8.8	3.0
Cheat River.								
Rowlesburg, W. Va	36	14	3.2	1	1.4	26-29	2.1	1.8
Youghiogheny River.								
Confluence, Pa	59	10	1.9	3	0.7	25-27	1.2	1.2
West Newton, Pa	15	23	2.5	3, 4	0.4	26, 27	1.3	2.1
Monongahela River.								
Weston, W. Va	161	18	0.7	29	— 0.9	24-27	—0.2	1.6
Fairmont, W. Va	119	25	16.5	4	12.2	21	14.7	4.3
Greensboro, Pa	81	18	9.5	4	7.0	26, 27	8.0	2.5
Lock No. 4, Pa	40	28	10.1	5	6.2	25, 26	7.7	3.9
Beaver River.								
Ellwood Junction, Pa	10	14	4.0	6, 10	2.1	31	3.3	1.9
Muskingum River.								
Zanesville, Ohio	70	25	9.8	1	7.9	27	8.7	1.9
Beverly, Ohio	20	25	7.3	1	4.6	26, 27, 31	5.5	2.7
Little Kanawha River.								
Glenville, W. Va	77	20	2.8	3	— 0.6	26	1.1	3.4
Creston, W. Va	38	20	6.0	3	3.0	25-27	3.6	3.0
New-Great Kanawha River.								
Radford, Va	213	14	1.5	8	0.3	18-21,25-29	0.7	1.2
Hinton, W. Va	153	14	3.4	7	1.7	26	2.4	1.7
Charleston, W. Va	58	30	7.9	5	4.4	16, 17	6.4	3.5
Scioto River.								
Columbus, Ohio	110	17	3.0	1-3	0.0	22	2.4	3.0
Licking River.								
Falmouth, Ky	30	25	2.5	9-11,29,30	0.9	23-25	1.8	1.6
Miami River.								
Dayton, Ohio	77	18	1.8	1,3	1.0	26	1.4	0.8
Kentucky River.								
Jackson, Ky	287	24	7.0	8	4.5	1	5.2	2.5
Beattyville, Ky	254	30	3.6	8	0.1	23-26,30,31	0.8	3.5
High Bridge, Ky	117	17	11.7	8	9.2	23-27	10.1	2.5
Frankfort, Ky	65	31	7.8	8	5.9	23-25, 28	6.6	1.9
Wabash River.								
Terre Haute, Ind	171	16	3.0	1-5	1.0	21-26, 30	1.9	2.0
Mount Carmel, Ill	75	15	5.2	1	2.5	29-31	3.7	2.7
Cumberland River.								
Burnside, Ky	518	50	7.3	10	1.5	24-26	2.9	5.8
Celina, Tenn	383	45	8.6	11	1.9	25	4.2	6.7
Cumberland River—Cont'd.								
Carthage, Tenn	308	40	6.1	12	1.9	25, 26	3.7	4.2
Nashville, Tenn	193	40	10.9	13, 14	8.1	25, 27, 28	9.4	2.8
Clarksville, Tenn	126	42	9.8	4	3.9	26	6.9	5.9
Powell River.								
Tazewell, Tenn	44	20	5.3	8	0.7	23-27	1.5	4.6
Clinch River.								
Speers Ferry, Va	156	20	4.3	7	0.0	2, 3	0.9	4.3
Clinton, Tenn	52	25	12.0	9	4.2	26	5.9	7.8
South Fork Holston River.								
Bluff City, Tenn	35	15	3.8	7	0.8	26, 31	1.6	3.0
Holston River.								
Mendota, Va	165	12	4.4	7	0.8	30, 31	1.5	3.6
Rogersville, Tenn	108	14	5.4	7	2.0	26-28, 31	2.8	3.4
French Broad River.								
Asheville, N. C	144	4	1.2	27	— 0.2	25	0.3	1.4
Leadvale, Tenn	70	15	3.5	7	0.5	2	1.7	3.0
Dandridge, Tenn	46	15	4.1	6	1.0	23-27	1.8	3.1
Little Tennessee River.								
McGhee, Tenn	17	20	4.5	4,7	3.2	24-26	3.7	1.3
Hiwassee River.								
Charleston, Tenn	18	22	3.6	1,3	1.3	25	2.3	2.3
Tennessee River.								
Knoxville, Tenn	635	29	7.3	8	1.4	26, 27	2.9	5.9
Loudon, Tenn	590	25	5.8	8	1.9	25	3.0	3.9
Kingston, Tenn	556	25	6.4	9	2.0	25-27	3.2	4.4
Chattanooga, Tenn	452	38	8.9	10	3.3	26, 27	5.0	5.6
Bridgeport, Ala	402	24	6.6	11	1.8	25, 26	3.3	4.8
Guntersville, Ala	349	31	10.0	12	4.1	25, 26	6.0	5.9
Florence, Ala	255	16	5.5	12, 13	1.5	25	3.2	4.0
Riverton, Ala	225	26	8.8	13	3.6	25	5.6	5.2
Johnsonville, Tenn	95	21	7.9	14	3.3	26, 27	5.4	4.6
Ohio River.								
Pittsburg, Pa	966	22	6.6	30, 31	2.8	16	4.9	3.8
Davis Island Dam, Pa	960	25	7.5	5	3.8	26, 27	5.4	3.7
Beaver Dam, Pa	925	27	10.4	6	4.0	28	7.0	6.4
Wheeling, W. Va	875	36	9.6	7	4.3	27	6.6	5.3
Parkersburg, W. Va	785	36	11.3	1	5.2	26, 27	7.5	6.1
Point Pleasant, W. Va	703	39	15.3	1	4.0	28	7.6	11.3
Catlettsburg, Ky	651	50	20.0	1	5.0	29	11.0	15.0
Portsmouth, Ohio	612	50	20.3	1	6.7	29	12.0	13.6
Maysville, Ky	559	50	19.6	2	6.6	30	12.2	13.0
Cincinnati, Ohio	499	50	21.3	2	9.3	29, 30	14.3	12.0
Madison, Ind	413	46	17.9	3	8.3	28, 29, 31	12.6	9.6
Louisville, Ky	367	28	8.0	4	4.0	28-31	5.9	4.0
Evansville, Ind	184	35	15.8	6	6.6	31	11.3	9.2
Mount Vernon, Ind	148	35	15.1	6	6.4	31	11.1	8.7
Paducah, Ky	47	40	16.8	1	6.2	28, 29	12.0	10.6
Cairo, Ill	1	45	28.8	1	16.4	29, 30	23.2	12.4
St. Francis River.								
Marked Tree, Ark	104	17	15.4	7	9.8	31	13.1	5.6
Neosho River.								
Neosho Rapids, Kans	326	22	3.6	27	1.3	21-23	1.7	2.3
Iola, Kans	262	10	2.4	31	0.2	18	0.7	2.2
Oswego, Kans	184	20	4.9	3	0.5	20	1.5	4.4
Fort Gibson, Ind. T	3	22	16.0	6	10.8	28	12.4	5.2
Canadian River.								
Calvin, Ind. T	99	10	4.6	1	2.6	15	3.3	2.0
Black River.								
Blackrock, Ark	67	12	14.9	4	4.8	31	8.0	10.1
White River.								
Calicorock, Ark	272	15	7.6	4	1.2	31	3.2	6.4
Batesville, Ark	217	18	10.8	5	3.3	31	5.6	7.5
Newport, Ark	185	26	18.2	7	4.5	31	10.1	13.7
Clarendon, Ark	75	30	27.1	1	16.9	31	24.2	10.2
Arkansas River.								
Wichita, Kans	832	10	— 0.1	2-4	— 0.7	23	—0.4	0.6
Tulsa, Ind. T	551	16	5.5	5	3.0	14, 21, 22	3.7	2.5
Webbers Falls, Ind. T	465	23	8.0	2,6	5.4	18-23	6.6	2.6
Fort Smith, Ark	408	22	16.1	4	4.4	23, 24	7.5	11.7
Dardanelle, Ark	256	21	19.0	4	3.9	26	7.8	15.1
Little Rock, Ark	176	23	20.5	5	5.9	26, 27	10.3	14.6
Pine Bluff, Ark	121	23	22.6	6,7	7.9	28	12.9	14.7
Yazoo River.								
Greenwood, Miss	175	38	20.1	15	7.5	31	14.1	12.6
Yazoo City, Miss	80	25	22.3	7	5.8	31	17.5	16.5
Ouachita River.								
Camden, Ark	304	39	33.7	9	5.9	31	16.1	27.8
Monroe, La	122	40	28.9	23, 24	25.2	9, 10	27.0	3.7
Red River								
Denison, Tex	768	22	11.4	3	2.1	13	6.0	9.3
Arthur City, Tex	688	27	26.0	4	8.5	16	14.5	17.5
Fulton, Ark	515	28	31.2	10	14.4	2	23.1	16.8
Shreveport, La	327	29	22.3	19	9.6	1	16.9	12.7
Alexandria, La	118	33	27.9	24	16.6	7	23.6	11.3
Mississippi River.								
Fort Ripley, Minn	2,082	10	8.4	1,2	7.3	20	7.8	1.1
St. Paul, Minn	1,954	14	12.0	31	7.5	19, 20	9.0	4.5
Red Wing, Minn	1,914	14	9.7	31	6.8	13,14,19,20	7.5	2.9
Reeds Landing, Minn	1,884	12	8.8	31	6.2	14	6.9	2.6
La Crosse, Wis	1,819	12	9.9	31	7.8	15,16,23,24	8.3	2.1
Prairie du Chien, Wis	1,759	18	12.4	1	9.0	26	9.7	3.4
Dubuque, Iowa	1,699	18	14.2	1	9.8	19-24	10.8	4.4
Clinton, Iowa	1,629	16	14.1	1	9.0	23	10.3	5.1
Leclaire, Iowa	1,609	10	9.5	1	6.0	18-23	6.9	3.5
Davenport, Iowa	1,593	15	12.9	1	7.8	22, 23	9.2	5.1
Muscatine, Iowa	1,562	16	13.9	1	9.0	22, 23	10.5	4.9
Galland, Iowa	1,472	8	7.6	1	4.4	21	5.4	3.2
Keokuk, Iowa	1,463	15	13.6	1	7.8	21-23	9.6	5.8
Warsaw, Ill	1,458	18	16.4	1	10.9	30	12.6	5.5
Hannibal, Mo	1,402	13	15.0	1	9.0	20-24	11.1	6.0
Grafton, Ill	1,306	23	17.4	1-3	10.7	25-27	13.5	6.7
St. Louis, Mo	1,264	30	22.4	8	13.0	27	17.4	9.4

TABLE VI.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Chester, Ill	1,189	30	18.6	9	11.3	28	14.7	7.3
Cape Girardeau, Mo	1,128	28	22.6	9	15.3	28-30	18.8	7.3
New Madrid, Mo	1,093	34	24.1	1	13.8	30,31	19.3	10.3
Luxora, Ark	905	33	18.5	1	7.0	31	13.0	11.5
Memphis, Tenn	843	33	24.6	1	10.8	31	17.2	13.8
Helena, Ark	767	42	38.3	1	15.4	31	25.7	22.9
Arkansas City, Ark	635	42	47.2	1	21.1	31	35.1	26.1
Greenville, Miss	595	42	42.2	1	17.2	31	30.2	25.0
Vicksburg, Miss	474	45	46.7	1	21.5	31	37.1	25.2
Natchez, Miss	378	46	46.6	1	26.6	31	39.7	20.0
Baton Rouge, La.(b)	240	35	35.0	1-7	23.6	31	31.4	11.4
Donaldsonville, La	188	28	27.3	1-5	17.0	31	24.2	10.3
New Orleans, La	108	16	17.3	3, 5, 7	11.3	31	15.5	6.0
Atchafalaya River.								
Simmesport, La	127	33	39.7	3-5	27.6	31	36.2	12.1
Melville, La	106	31	36.0	4	28.9	31	33.9	7.1
Morgan City, La	19	8	5.0	7, 13, 24	3.0	29	4.4	2.0
Grand River.								
Grand Rapids, Mich	38	11	2.7	17, 18	1.7	28	2.1	1.0
Sandusky River.								
Tiffin, Ohio	65	8	0.6	3	0.3	17-22,25-31	0.4	0.3
Maumee River.								
Napoleon, Ohio	44	13	0.3	1	— 0.4	9	—0.1	0.7
Connecticut River.								
Hartford, Conn	50	13	18.5	30	5.6	26, 27	9.1	12.9
Mohawk River.								
Utica, N. Y	98	6	5.5	27	2.0	2	3.7	3.5
Tribeshill, N. Y	42	12	4.8	29	0.4	23,24	1.7	4.4
Schenectady, N. Y	19	15	5.6	28	1.4	23-27	2.2	4.2
Hudson River.								
Troy, N. Y	154	14	7.5	6	4.3	25	5.5	3.2
Albany, N. Y	147	12	8.8	29	2.1	17	4.4	6.7
Pompton River.								
Pompton Plains, N. J	6	8	5.1	29	4.2	27	4.5	0.9
Passaic River.								
Chatham, N. J	69	7	4.0	29	2.3	27	2.8	1.7
Lehigh River.								
Mauch Chunk, Pa	45	15	5.4	28, 29	4.1	15-19	4.4	1.3
Schuylkill River.								
Reading, Pa	66	12	1.1	29	0.1	26, 27	0.5	1.0
Delaware River.								
Hancock (E. Branch), N. Y.	269	12	5.4	29	3.3	26, 27	3.8	2.1
Hancock (W. Branch), N. Y.	269	10	4.7	29	3.2	26	3.6	1.5
Port Jervis, N. Y	204	14	3.8	31	0.8	27	1.7	3.0
Phillipsburg, N. J	142	26	5.9	30	1.8	27	3.1	4.1
Trenton, N. J	92	18	4.3	31	1.6	27	2.4	2.7
North Branch Susquehanna.								
Binghamton, N. Y	183	16	8.0	29	2.4	25, 26	3.6	5.6
Towanda, Pa	139	16	8.8	28	1.6	26	3.1	7.2
Wilkes-Barre, Pa	60	17	14.2	29	4.2	26, 27	6.3	10.0
West Branch Susquehanna.								
Clearfield, Pa	165	8	2.0	4	0.8	26	1.3	1.2
Renovo, Pa	90	16	6.3	28	1.6	23, 24	2.5	4.7
Williamsport, Pa	39	20	8.4	29	1.8	24	3.2	6.6
Juniata River.								
Huntingdon, Pa	90	24	4.4	3	3.2	24-26	3.5	1.2
Susquehanna River.								
Selinsgrove, Pa	116	17	6.4	30	0.7	27	2.0	5.7
Harrisburg, Pa	69	17	7.3	30	2.0	26	3.2	5.3
Shenandoah River.								
Riverton, Va	58	22	— 0.5	1-30	— 0.5	1-30	—0.5	0.0
Potomac River.								
Cumberland, Md	290	8	2.6	1-4	1.8	26, 29-31	2.2	0.8
Harpers Ferry, W. Va	172	18	3.5	1	0.4	29-31	1.7	3.1
James River.								
Buchanan, Va	305	12	3.5	6-8	2.4	26	2.9	1.1
Lynchburg, Va	260	18	1.3	8, 28	0.8	6, 18-26	1.0	0.5
Columbia, Va	167	18	6.0	29	3.0	25, 26	4.0	3.0
Richmond, Va	111	12	1.3	30	— 0.1	13	0.6	1.4
Dan River.								
Danville, Va	55	8	0.8	28	— 0.1	26	0.2	0.9
Roanoke River.								
Clarksville, Va	196	12	3.0	28	— 0.1	26	0.7	3.1
Weldon, N. C	129	30	12.4	30	9.3	24-27	10.2	3.1
Tar River.								
Tarboro, N. C	46	25	5.1	10, 30, 31	1.6	28	3.2	3.5
Greenville, N. C	21	22	5.9	11	3.6	20	4.4	2.3
Haw River.								
Moncure, N. C	171	25	9.0	29	8.2	17-27	8.4	0.8
Cape Fear River.								
Fayetteville, N. C	112	38	8.0	30	2.6	27	4.4	5.4
Waccamaw River.								
Conway, S. C	40	7	2.7	9	1.2	21	2.0	1.5
Pedee River.								
Cheraw, S. C	149	27	8.3	7	2.0	26	3.7	6.3
Smiths Mills, S. C	51	16	8.9	12	2.4	29	5.6	6.5
Lynch Creek.								
Effingham, S. C	35	12	6.3	9, 10	3.6	27, 28	4.9	2.7
Black River.								
Kingstree, S. C	45	12	3.3	1	0.7	28, 29	2.2	2.6
Catawba-Wateree River.								
Mount Holly, N. C	143	15	2.6	27, 28	1.8	21-26	2.0	0.8
Camden, S. C	54	24	10.3	8	4.7	21	6.9	5.6
Broad River.								
Blairs, S. C	36	14	3.4	28	0.6	23	1.7	2.8
Saluda River.								
Chappels, S. C	56	14	6.5	8, 29	2.0	26	3.6	4.5
Congaree River.								
Columbia, S. C	52	15	3.0	29	0.7	20	1.6	2.3
Santee River.								
St. Stephens, S. C	50	12	7.2	11-13	2.4	24	5.1	4.8
Edisto River.								
Edisto, S. C	75	6	2.8	11-15	1.0	25-27	2.0	1.8
Broad River.								
Carlton, Ga	30	11	4.1	27	2.3	25	3.1	1.8
Savannah River.								
Calhoun Falls, S. C	347	15	4.0	7	2.8	18-20, 23, 24	3.1	1.2
Augusta, Ga	268	32	13.0	28	7.5	23, 24	9.1	5.5
Oconee River.								
Milledgeville, Ga	147	25	5.7	8	3.1	20, 22, 25	3.7	2.6
Dublin, Ga	79	30	3.0	11	0.7	19, 20	1.4	2.3
Ocmulgee River.								
Macon, Ga	203	18	4.8	8, 9	2.2	25, 27	3.0	2.6
Abbeville, Ga	96	11	6.0	11	2.8	21, 22	4.0	3.2
Flint River.								
Woodbury, Ga	227	10	1.4	8	0.3	20, 25	0.6	1.1
Montezuma, Ga	152	20	6.4	9	2.5	23	3.7	3.9
Albany, Ga	90	20	7.2	9	1.7	3, 4	3.5	5.5
Bainbridge, Ga. (c)	29	22	.....	.....	3.5	3, 4	5.5	.....
Chattahoochee River.								
Oakdale, Ga	305	18	4.8	7	3.0	31	3.9	1.8
West Point, Ga	239	20	5.5	8	2.5	22	3.5	3.0
Eufaula, Ala	90	40	11.0	9	2.8	23, 31	5.2	8.2
Alaga, Ala. (c)	30	25	13.5	9	5.0	1	6.9	8.5
Coosa River.								
Rome, Ga	266	30	5.6	27	2.0	20-26	2.9	3.6
Gadsden, Ala	162	22	5.7	9	1.9	23-26	3.0	3.8
Lock No. 4, Ala	113	17	4.6	10	1.5	25-28	2.6	3.1
Wetumpka, Ala	12	45	15.6	8	4.8	28, 29	7.5	10.8
Tallapoosa River.								
Milstead, Ala	42	35	14.8	8	2.6	21, 27-31	4.4	12.2
Alabama River.								
Montgomery, Ala	323	35	13.5	9	2.3	28-30	4.8	11.2
Selma, Ala	246	35	18.0	10	3.6	31	7.3	14.4
Black Warrior River.								
Tuscaloosa, Ala	90	43	13.4	8	5.9	23	8.3	7.5
Tombigbee River.								
Columbus, Miss	316	33	9.5	8	— 2.4	25, 31	0.9	11.9
Vienna, Ala	246	42	14.5	9	1.3	27	5.7	13.2
Demopolis, Ala	168	35	24.9	9	1.7	24	8.2	23.2
Leaf River.								
Hattiesburg, Miss	60	20	9.8	10	3.6	4, 5	5.0	6.2
Chickasawhay River.								
Enterprise, Miss	144	18	17.2	8	2.2	3, 22, 23	5.9	15.0
Shubuta, Miss	106	25	27.0	10	3.0	3, 4	12.2	24.0
Pascagoula River.								
Merrill, Miss	78	20	13.8	13	3.3	2, 3	7.9	10.5
Pearl River.								
Jackson, Miss	242	20	15.9	10	3.2	1	8.4	12.7
Columbia, Miss	110	14	11.4	11, 12	6.3	4, 5	8.7	5.1
Sabine River.								
Logansport, La	315	25	16.0	31	10.8	1	13.4	5.2
Neches River.								
Rockland, Tex	105	20	7.8	7	3.2	25, 31	5.5	4.6
Beaumont, Tex	18	10	1.9	15	1.1	29	1.4	0.8
Trinity River.								
Dallas, Tex	320	25	35.2	18	6.4	1	21.7	28.8
Long Lake, Tex	211	35	39.8	31	12.9	4	28.4	26.9
Riverside, Tex	112	40	21.5	25, 26	8.1	6	16.0	13.4
Liberty, Tex	20	25	20.9	29	11.1	9	16.4	9.8
Brazos River.								
Kopperl, Tex	345	21	6.8	4	0.4	1, 2	2.5	6.4
Waco, Tex	285	24	10.2	28	3.2	3	6.2	7.0
Valley Junction, Tex	215	40	13.5	26	4.0	18	7.1	9.5
Hempstead, Tex	140	40	16.6	27	3.0	1	7.4	13.6
Booth, Tex	61	39	9.8	20	5.2	9	7.1	4.6
Colorado River.								
Ballinger, Tex	489	21	6.8	24	1.8	1-21, 30, 31	2.2	5.0
Austin, Tex	214	18	5.8	27	1.5	12, 13	2.3	4.3
Columbus, Tex	98	24	11.8	30	6.2	24	7.4	5.6
Guadalupe River.								
Gonzales, Tex	112	22	0.8	1, 2	0.5	19-26, 31	0.6	0.3
Victoria, Tex	35	16	4.8	27	0.9	21	1.7	3.9
Rio Grande River.								
San Marcial, N. Mex	1233	14	10.9	22, 23	8.9	5	10.1	2.0
El Paso, Tex	1630	14	11.3	18, 27	9.2	6-9	10.5	2.1
Red River of the North.								
Moorhead, Minn	284	26	14.0	17	10.7	15	12.0	3.3
Kootenai River.								
Bonners Ferry, Idaho	123	24	17.5	14	11.5	1	14.1	6.0
Pend d'Oreille River.								
Newport, Wash	86	14	7.0	30, 31	4.6	1	6.1	2.4
Snake River.								
Lewiston, Idaho	144	24	10.3	13, 14	7.4	23-25	8.6	2.9
Riparia, Wash	67	30	10.5	13	8.0	21, 25	8.9	2.5
Columbia River.								
Wenatchee, Wash	473	40	24.4	28-30	17.9	1	22.1	6.5
Umatilla, Oreg	270	25	14.7	31	10.7	1	12.5	4.0
The Dalles, Oreg	166	40	21.8	31	16.4	1, 2	19.0	5.4
Willamette River.								
Albany, Oreg	118	20	8.8	30	3.2	15	4.2	5.6
Salem, Oreg	84	20	6.1	31	1.9	14, 15	2.8	4.2
Portland, Oreg	12	15	11.8	31	8.8	2	10.4	3.0
Sacramento River.								
Red Bluff, Cal	201	23	14.8	27	3.4	23, 24	6.2	11.4
Sacramento, Cal	64	25	22.2	11	20.5	24	21.5	1.7

Honolulu, T. H., latitude 21° 19′ north, longitude 157° 52′ west; barometer above sea, 38 feet; gravity correction, —.057, applied. May, 1906.

Day.	Pressure.*		Air temperature.				Moisture.				Wind.				Precipitation.		Clouds.					
							8 a. m.		8 p. m.		8 a. m.		8 p. m.				8 a. m.			8 p. m.		
	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Maximum.	Minimum.	Wet.	Relative humidity.	Wet.	Relative humidity.	Direction.	Velocity.	Direction.	Velocity.	8 a. m.	8 p. m.	Amount.	Kind.	Direction.	Amount.	Kind.	Direction.
1	30.00	29.98	71.0	68.1	76	64	60.9	56	61.1	67	ne.	9	ne.	7	0.00	0.00	1 1	Ci.-cu. A.-s.	w. w.	few.	S.-cu.	0
2	29.98	29.95	74.6	72.7	77	65	62.5	50	67.0	74	n.	4	e.	2	0.00	0.00	1 1	A.-cu. S.-cu.	w. 0	7 2	A.-cu. S.-cu.	sw. 0
3	29.96	29.94	73.9	73.3	79	67	67.4	71	67.3	73	nw.	4	ne.	6	T.	0.01	5 5	S.-cu. N.	e. e.	1	Cl.-s.	w.
4	29.95	29.98	78.2	74.3	80	70	69.3	64	68.1	73	se.	8	e.	9	0.00	0.01	8 1	Cl.-s. Cu.	w. e.	3 1	Cl.-s. S.-cu.	w. ?
5	30.03	30.04	77.4	74.5	80	72	66.5	56	66.0	64	ne.	9	ne.	7	0.00	0.01	1	S.-cu.	e.	2 4	A.-s. S.-cu.	0 e.
6	30.04	30.05	73.0	72.9	79	71	68.0	78	67.5	76	ne.	5	ne.	8	0.01	0.01	4 5	S.-cu. N.	e. e.	2 4	Cu. N.	e. e.
7	30.08	30.08	73.4	74.0	78	69	66.8	71	65.5	63	ne.	13	ne.	13	0.01	0.01	1 5	Cu. S.-cu.	e. e.	7	S.-cu.	e.
8	30.13	30.14	73.9	70.0	78	70	64.9	61	65.0	77	ne.	9	ne.	9	0.04	0.03	2 4	Cu. S.-cu.	ne. ne.	10	N.	0
9	30.15	30.16	74.0	72.8	77	69	65.5	63	64.2	63	e.	8	ne.	11	0.09	T.	2 6	Cu. S.-cu.	e. e.	6	S.-cu.	e.
10	30.13	30.11	74.4	70.7	79	69	65.3	61	66.0	78	ne.	8	ne.	9	0.03	0.01	4	S.-cu.	e.	9	N.	e.
11	30.12	30.10	71.8	73.0	77	69	65.6	72	64.4	63	ne.	12	ne.	5	0.05	T.	4 6	S.-cu. N.	e. e.	7	S.-cu.	e.
12	30.10	30.10	71.7	73.0	75	69	65.5	72	65.5	67	ne.	14	e.	8	0.01	0.06	1 9	Ci. S.-cu.	0 e.	3 5	S.-cu. N.	e. e.
13	30.13	30.11	72.5	74.0	79	72	67.0	75	66.3	66	e.	11	e.	13	0.02	T.	4 5	S.-cu. N.	e. e.	6	S.-cu.	e.
14	30.15	30.12	75.0	74.5	79	69	66.1	62	65.6	62	e.	17	ne.	20	0.02	0.00	1 6	Cu. S.-cu.	e. e.	3	S.-cu.	e.
15	30.13	30.12	75.0	74.0	80	70	67.0	66	66.2	66	ne.	5	ne.	11	0.01	0.03	6	S.-cu.	e.	8	S.-cu.	e.
16	30.12	30.12	74.7	73.4	78	70	67.0	67	66.2	68	ne.	6	ne.	9	0.05	T.	4 2	S.-cu. N.	e. e.	4	N.	0
17	30.11	30.11	76.2	73.0	79	71	67.4	63	67.5	75	ne.	5	ne.	11	0.02	T.	1 3	Cu. S.-cu.	e. e.	2 3	S.-cu. N.	0 0
18	30.10	30.10	76.9	74.4	81	71	66.5	57	66.3	65	ne.	10	ne.	11	T.	0.00	1	Cu.	e.	2	S.-cu.	?
19	30.10	30.07	77.0	71.0	80	68	67.2	60	67.5	84	ne.	7	e.	6	T.	0.01	6 1	Ci.-s. S.-cu.	w. e.	10	N.	0
20	30.06	30.05	74.1	74.2	79	67	68.1	74	67.2	69	nw.	2	e.	8	0.10	0.07	1 8	A.-s. S.-cu.	w. e.	4	S.-cu.	e.
21	30.07	30.07	76.6	73.4	80	71	65.5	55	66.0	67	ne.	4	n.	11	0.00	0.00	2	S.-cu.	e.	6	S.-cu.	e.
22	30.06	30.04	76.0	74.2	80	71	66.1	59	66.2	65	ne.	5	e.	10	0.01	0.00	1 2	Cu. S.-cu.	e. e.	1	S.-cu.	e.
23	30.08	30.07	75.9	74.0	80	73	66.4	61	66.2	66	e.	12	e.	3	0.00	T.	5	S.-cu.	e.	2	S.-cu.	e.
24	30.02	30.10	75.4	74.0	79	71	68.4	70	65.0	61	e.	7	ne.	10	0.02	0.00	8	S.-cu.	e.	6	S.-cu.	e.
25	30.10	30.10	74.0	74.5	80	70	65.4	63	66.4	65	ne.	8	e.	10	0.03	0.00	7	S.-cu.	e.	7	S.-cu.	e.
26	30.08	30.07	75.1	74.5	79	72	66.2	62	66.5	66	e.	9	ne.	11	0.00	T.	7	S.-cu.	e.	5	S.-cu.	e.
27	30.06	30.06	75.1	75.4	78	71	67.6	68	68.4	78	e.	5	ne.	4	T.	T.	7 3	S.-cu. N.	e. e.	6 4	S.-cu. N.	e. 0
28	30.06	30.05	76.8	73.4	82	72	69.0	68	68.3	70	ne.	7	ne.	8	T.	0.00	2 6	Cu. S.-cu.	e. e.	5 3	Cl.-s. S.-cu.	w. e.
29	30.06	30.08	75.0	75.8	82	72	69.8	77	68.0	67	ne.	8	ne.	6	0.01	T.	8 1	S.-cu. N.	e. e.	7	S.-cu.	e.
30	30.10	30.07	78.5	75.8	82	73	70.0	66	69.0	71	e.	5	e.	4	0.00	T.	7	S.-cu.	e.	few. few.	Cu. S.-cu.	e. e.
31	30.10	30.09	76.8	75.4	80	71	71.9	79	68.9	72	ne.	1	n.	3	0.05	0.18	9	S.-cu.	e.	4 3	Cl. S.-cu.	? e.
Mean	30.078	30.072	75.0	73.5	79.1	70.0	66.8	65.4	66.4	69.1	ne.	7.7	ne.	8.5	0.58	0.44	6.5	S.-cu.	e.	5.6	S.-cu.	e.

Observations are made at 8 a. m. and 8 p. m., local standard time, which is that of 157° 30′ west, and is 5h and 30m slower than 75th meridian time. *Pressure values are reduced to sea level and standard gravity.

RAINFALL IN JAMAICA.

Through the kindness of Dr. H. H. Cousins, chemist to the government of Jamaica and now in charge of the meteorological service of that island, we have received the following table.

The rainfall for May was very much above the average for the whole island. The greatest fall, 32.91 inches, occurred at Troy, in the west-central division, while the least, 2.85 inches, fell at Drax Hall in the northern division.

Comparative table of rainfall.

[Based upon the average stations only.]

MAY, 1906.

Divisions.	Relative area.	Number of stations.	Rainfall.	
			1906.	Average.
	Per cent.		*Inches.*	*Inches.*
Northeastern division	25	23	11.94	11.75
Northern division	22	43	9.00	7.08
West-central division	26	22	17.48	11.86
Southern division	27	32	14.48	7.93
Means	100		13.23	9.66

Hotelstein 9-29-16